The Locomotive Fleet of CSXT

by

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Table of Contents

PREFACE..8

AUTHOR..12

CSX CORPORATION...12

SUPPLIERS OF DIESEL LOCOMOTIVES IN THE U.S. ...13

EMD..13

EMD Manufacturing...14

GE Transportation...15

GE Locomotive Manufacturing...15

National Railway Equipment Co..17

NRE Locomotive Manufacturing..17

CSXT DC LOCOMOTIVES...18

EMD DC Locomotives...20
- EMD SD-38..21
- SD-40..21
- SD-40-2...22
- SD40-3..23
- F40PH-2..23
- SD50...23
- SD60...24

GE DC locomotives...27
- GE Dash-8..27
- C40-8..27
- CW40-8...28

C40-8 ... 28
CW40-8B (B40-8) ... 29
C40-8W ... 29
C40-9W ... 29
C44-9W ... 30

The Wabtech QES-III Locomotive computer ... 30

AC LOCOMOTIVES PRIMER ... 32

CSXT'S AC LOCOMOTIVES ... 35

EMD AC Locomotives ... 35
SD70MAC ... 36
SD70ACe-T4 ... 39
SD80MAC ... 40
SD89MAC ... 42
What's new at EMD? ... 44

GE's AC Locomotives ... 46
GE C40-8w ... 46
GE DASH-9 ... 47
AC4400CW ... 47
AC6000 (CW60-9 AC) ... 51

What's new at GE ... 52

ES40DC ... 53

ES44AH ... 54

ES44AH (T4C) ... 54

What's next from GE? ... 54

NRE ... 55

3GS21B ... 55

3GS21C ... 55

2GS14B 56

R. J. CORMAN 56

RP20BD 56

RP20CD 56

WHAT'S NEXT FOR CSXT? 56

LOCOMOTIVES INHERITED FROM PREDECESSOR ROADS 57

EMD locomotives from predecessor roads 59
- F7A/F7B 59
- EMD SW series 61
- MP15 62
- GP15/15T/15-1 63
- GP30 64
- GP-38/GP-38-2 67
- GP39/GP39-2 69
- GP40 69
- GP-40-2 73
- GP40-3 76
- GP60 77
- Six-axle Power 77
- SD20-2 77
- SD35 78
- SD38-2 80
- SD40 80
- SD40-2 81
- SD40M-2 84
- SD40-E3 84
- SD45 84
- SD50 86
- Road Slugs 87
- Road Mates 94
- Yard Slugs 94

GE locomotives from predecessor roads 97

The U-boats....97
U18B....97
U23B....98
The DASH-7 line....99
B23-7/BQ23-7....99
B30-7....100
B36-7....101
C30-7....101

PUMPKINS....102

FUEL TENDERS....104

MU AND CONSISTING....104

LOCOMOTIVE SERVICING....107

EMD Servicing - Cumberland Shops....108

PRIME MOVERS....110

EMD Prime movers....110
EMD-567 110
EMD-645....111
EMD-710....113
EMD Prime movers by Locomotive model....113

GE Prime Movers....114
7FDL....114
GEVO....115
HDL Series....116
Powerhaul....116

NRE Prime movers....116

CSXT PAINTING AND LETTERING SCHEMES....118

HERITAGE LOCOMOTIVES....119

SPIRIT LOCOMOTIVES..120

CSXT OLDER UNITS, NO LONGER ON THE ROSTER. 121

Miscellaneous First-Generation EMD switchers..123
NW2..124
GP7..125
GP9..126
GP11 and GP16..128
GP18...128
GP35...129
H-15...130
SD7..130
SD9..131
SD18...131
U25B...132
U28C...133
U30B...133
U30C...134
U33B...134
U36B...135
U36C...135

MATE...135

E8A..136

C39-8..136

C32-8..137

C36-7..137

SW-1001..137

OUT TO PASTURE, OR WORSE.......................................137

POSITIVE TRAIN CONTROL..137

AFTERWORD...138

GLOSSARY OF TERMS..139

REFERENCES...157

RESOURCES..162

Roster resources...166

I had asked CSX Corporate for permission to use their route map on the cover of this book, but they said "Due to safety and railroad operational concerns, we cannot oblige your request at this time." So, just use your imagination.

Preface

Rich in very diverse railroad history CSX Transportation (CSXT) is the largest eastern railroad and also one of the safest in the country. CSXT is the end result of over 150 years of railroad evolution in the United States. The largest part of CSXT consists of elements of the Chessie System and the Seaboard Coast Lines. Dozens of “fallen flag” lines such as the Baltimore & Ohio, Chesapeake & Ohio, Western Maryland, Atlantic Coast Line, Richmond, Fredericksburg, and Potomac, Family Line,s and many more make up the modern CSXT.

CSXT's rail spans the United States east of the Mississippi exclusive of New England. The northern portion, the Chessie system heritage serves the industrial northeast and the coal fields of Maryland, West Virginia, Pennsylvania and Kentucky. The southern section, from the SCL, handles minerals, chemicals and ocean ports. The building blocks of CSXT are the history, roadbed, and hard work of hundreds of predecessor roads, from the very beginning of flanged wheel on iron rail in America.

From a 50 year old SW1200 workhorse switching cars in a yard, to mile-long unit coal trains headed by 15,000 horsepower of modern AC traction, CSXT never sleeps.

CSX Transportation (CSXT) is the railroad business unit within CSX Corporation. CSXT is a Class-1 railroad, with over 23,000 route miles in 23 eastern states. The CSX Corporation, headquartered in Richmond, Virginia, generates $10.5 billion in revenue and employs 48,000 workers. CSXT is headquartered in Jacksonville, Florida, CSXT has over 24,000 employees and operates an average of 1,300 trains per day, most with multiple locomotives. It has over 4,000 locomotives, 84,000 freight cars and over 31,000 miles of track. CSXT can trace its roots back to the

1827 charter of the Baltimore & Ohio (B&O) Railroad in Maryland.

Other CSX Corporation business units handle barge traffic on the U. S. inland waterways and ocean-going container ships. Facilities exist to trans-load containers to and from ships, trains, trucks and barges. Multiple massive MiJack-1000 RDS cranes span loading tracks and have an inside clearance of 70 feet. Their capacity is 100,000 pounds and each can handle thirty containers per hour. These seven overhead cranes are in addition to six sideloaders at the Chicago facility.

Unit coal trains also load directly to bulk ships. CSXT rail lines serve 26 Atlantic and Gulf ports, including seven coal export ports. As the leader in U. S. railroads for coal hauled, CSXT moved 165 million tons last year. At the Toledo Docks on Lake Erie, 10 million tons of coal are loaded on ships per year, mostly from unit coal trains. There are two specialized machines here for loading ships, of 6,000 and 3,000 tons/hour capacity. Coal shipment provides one third of CSXT's revenue. Agricultural products, grain, corn, soybeans and other products are handled in 5,160 cubic foot capacity *Grain Express* cars. Metal ores are hauled to mills in covered hoppers. The finished products -- pipe, coil steel, bar, rod, structural and plate steel, can stock and aluminum ingots -- are hauled in 100-ton-capacity gondolas. Triple deck, enclosed auto racks speed shipment of new cars from factories to distribution points and for export. The newer, higher Sport Utility vehicles require double deck cars. CSXT hauls one-third of all the new autos manufactured in the United States. A major rail customer is piggy-back road trailers, with United Parcel Service having its own unit trains. The bright orange Tropicana Juice train from Florida travels up the Eastern seaboard several times per week. CSXT also handles chemicals, phosphates and fertilizers, forest products, consumer goods and general freight. CSX now longer owns the Greenbriar Lodge in West Virginia, nor the Grand Teton Lodge.

CSXT considers July 1, 1986 as its official birthday. On that date, the Seaboard System Railroad changed its name to CSX Transportation, Inc., as the first step in the formation of the new entity. It's history started before then, however, as Hays Watkins engineered CSXT as a holding company for Chessie and Seaboard in November 1980. The Chessie System, consisting of the B&O and Chesapeake & Ohio (C&O) still existed in 1986 as an independent company. On April 30, 1987, the B&O (including the Western Maryland) was formally merged into the C&O. Then on September 2, 1987, the C&O was merged into CSXT. In 1991, CSXT brought the Richmond, Fredericksburg & Potomac Railroad (RF&P) into the Corporation. This line rostered only ElectroMotive Division (EMD) locomotives. They were renumbered into the CSXT scheme by 1992. Even late in 1992, about one third of the CSXT motive power fleet remained in a predecessor paint scheme. In 1998, CSXT absorbed more motive power from Conrail. CSXT and Norfolk Southern had jointly purchased the assets of Conrail, and the motive power, rolling stock, and operations were divided among the purchasing entities. Conrail motive power assets were divided among CSXT and Norfolk Southern according to a complex, negotiated formula. Conrail locomotives marked PRR went to Norfolk Southern, and those lettered NYC went to CSXT. These were the still-active reporting marks of Conrail predecessors Pennsylvania Railroad and New York Central.

CSXT uses locomotives from major United State's manufacturers General Electric (GE) and Electromotive Division (EMD), as well as new-comer NRE.

Because of its history of being built up from consolidation of predecessor roads, CSXT has a wide and varied selection of motive power inherited from other lines. This situation can present a major maintenance headache, in terms of the different parts, procedures and training required.

The CSXT fleet of locomotives at the end of 2018 numbered around 4,000 locomotives. This book will focus on the most recent locomotive acquisitions of CSXT from GE, EMD, and NRE costing more than a million dollars per unit and developing 6,000 horsepower. One of these units can replace multiple units of previous generation motive power. Microprocessor control of wheel slip allows putting more of the massive weight into tractive effort than any previous units to work pulling tonnage. Six AC traction motors transform the 6,000 horsepower from the diesel prime mover to tractive effort on the rails.

CSXT started a consolidation of their diverse motive power fleet in September of 1986 with the establishment of the CSXT Operations Center in Jacksonville, Florida. In 1988, a fleet modernization program, involving the scrapping of older motive power and the purchasing of new diesels was started. Older workhorses were scrapped and traded-in by the hundreds on more modern units. CSXT was getting its own identity, more than the sum of its predecessor parts.

As this book was being prepared, CSX has 3873 units on its roster, with 800 being stored. That gives some 13,225,000 raw horsepower available.

Although many knowledgeable people reviewed this work and uncovered many errors and omissions in the process, I managed to slip a few past them. Let us know about these, so I can correct future editions.

This is a data book, not a color picture book, to keep costs down. There are numerous websites and books with nice color pictures of CSX locomotives mentioned in the Reference and Resources sections.

Keep in mind, the roster changes daily, and your most up-to-date information will be found on the Internet. The section of this book called “Resources” suggests some starting points.

Author

Mr. Stakem is a member of the Council of the Alleghenies, the C&O Canal Association, and serves as the Historian for the Western Maryland Chapter of the National Railway Historical Society. He is also a member of the Western Maryland Railway Historical Society, the Locomotive and Railway Historical Society, the Preservation Society of Allegany County, The Mountain State Logging and Railroad Historical Society, and the Westernport Heritage Society. He has published several books about railroads in Allegany County,Maryland, including Cumberland & *Pennsylvania Revisited* and *Railroading around Cumberland*. He has also co-authored *CSX Diesel Locomotives* and *Western Maryland Diesel Locomotives* with his son. A native of Cumberland, he teaches for the Whiting School, Johns Hopkins. University.

If you want to contact me, I hang out at the Facebook site of the Western Maryland Chapter of the National Railway Hostoricval Society, WesternMarylandNRHS.

Mr. Stakem has degrees in Electrical Engineering, Computer Science, and Applied Physics from Carnegie-Mellon University and the Johns Hopkins University. In the interest of fair disclosure, he is a CSX shareholder.

Mr. Stakem's maternal Grandfather, Claude (Jake) Ward was an engineer for the Cumberland & Pennsylvania Railroad in Western Maryland. He retired after World War -2, never having driven a diesel locomotive.

CSX Corporation

CSX Corporation, a major Class-1 railroad operator in the United States, has its headquarters and operations center in Jacksonville, Florida. It has about 21,000 miles of track in 23 eastern states. It can trace its ancestry back to the Baltimore and Ohio Railroad, the first railroad in the United States. The current company was established in 1980, from the Chessie System, and the Seaboard Coast Line. The C and The S formed the first two letters in the Corporation's name. The lawyers decided to use CSX. The reporting mark for the company's equipment is CSXT. This was not carried by equipment until 1986. In 1995, CSX introduced their policy of no steam power on their rails, for safety reasons.

CSX touches the Atlantic and Gulf Coasts, the Mississippi, and the Great Lakes. The Northern Region of CSX has 6 divisions, Great Lakes, Chicago, Albany, Baltimore, Louisville, and Montreal. The Southern Division has four regions, the Atlanta, the Nashville, the Florence (SC), and the Jacksonville.

Suppliers of Diesel Locomotives in the U.S.

First, we will discuss the companies that supply diesel locomotives in the U. S. to CSX. The railroad is a customer of all three. It also uses several rebuilders to overhaul its fleet, and purchases some older used units. Railroads will also sometimes have an immediate need for power on a short term basis, and will use leased units in their consists.

EMD

The Electo-Motive Engineering Corporation was founded in 1922 in Cleveland, Ohio, and later renamed the Electro-Motive

Company. It designed and produced gasoline-electric rail cars. These used motors and controls from General Electric. In 1930, the company was sold to General Motors, who had also purchased the Winton Engine Company. The resultant company was known as the Electro-Motive Division of GM. Locomotives were manufactured in 1941. The Greenbriar Equity Group and Berkshire Partners bought EMD in 2005. They renamed the company Electro-Motive Diesel, to leave the company initials the same. In 2010, Progressive Rail Services bought the Company. At that time, it had about 30% of the U.S. Market. Caterpillar owns Progress Rail.

Their main facility is in LaGrange, Illinois, with a final assembly plant in Muncie, Indiana. They rebuild traction motors in a facility in Mexico.

EMD Manufacturing

At one time, EMD had four major plants for locomotive production: two in Illinois, one in Cleveland, Ohio and one in London, Ontario, Canada. Most production occurred at Plant number one at LaGrange, Il, outside of Chicago, from 1934 to 1988. Groundbreaking on the LaGrange plant started in March 1935. Plant No. Two in Illinois, now closed, did subassembly work. Plant No. three in Cleveland, now sold, constructed some road switchers. EMD production has since been consolidated in London, Ontario. LaGrange serves as the headquarters, engineering facility, training center, and parts manufacturing center. The design of the modern diesel road switcher locomotive owes much to engineer Dick Dilworth and his truck expert Martin Blomberg, among others.

In 1930, General Motors purchased EMC Corporation, a gas-electric railcar manufacturer founded by H. L. Hamilton. They also purchased the Winton Engine Company, EMC's supplier of diesel and gas prime movers and merged both companies into the Electro-Motive Division of GM in 1941.

EMD was the leading manufacturer of diesel-electric locomotives from 1945 to 1983, having at one time an 89 percent market share. In fact, this triggered a Department of Justice Antitrust action against GM for monopolization of the diesel-electric locomotive market. EMD is currently owned by Caterpillar, another manufacturer of big diesel-powered equipment.

GE Transportation

GE Transportation (GERail) is a division of the General Electric Company. Their main Lawrence Park plant is located in Erie, Pa. Engine manufacturing also takes place in Grove City, PA. There is a new (2013) Engine Plant in Fort Worth Texas. GERail has also merged with Wabtec, the Westinghouse Air Brake Technology Company Wabtec).

With the closing of the plant, the region will lose jobs, estimated at 600. Previously, GE had laid off 2,000. Pensions and healthcare coverage will not transition to the new company.

At the end of 2018, as this book was being written, the 110 year-old plant in Erie was closed, with manufacturing switched to Texas. GE Manufacturing Solutions has already produced 1,000 locomotives.

GE also maintains an locomotive motor re-manufacturing facility in Las Vegas. GE is merging its locomotive business, GE Transportation, with Wabtec (previously, Westinghouse) in an $11. billion dollar deal.

GE Locomotive Manufacturing

GE Transportation Group had a 350-acre site in Erie, Pennsylvania for manufacture of freight and passenger locomotives, rapid transit cars and large off-road vehicles. The first building was erected in 1910 and eventually over 3.8 million square feet of manufacturing space was under roof. There are four miles of test track at the campus at 2901 East Lake Road. GE Transportation Systems was the largest employer in Erie, Pennsylvania. The rail transportation group employs 5,500 and its products are used world-wide. Additional engine manufacturing facilities are located in Grove City, Pennsylvania, a $100 million plant built in 1984. GE-Harris Railway Electronic Products of Melbourne, Florida, produces signaling and communications equipment.

In 1880, Thomas Edison experimented with an electric locomotive at his facility in Menlo Park, NY. In 1888, The Thomson-Houston Company was installing electric industrial locomotives. By 1892, GE was formed from the merger of the Edison General Electric Company and Thomson-Houston. GE Transportation Systems immediately got into some high-profile projects, supplying the electric elevated railroad for the 1893 Chicago Colombian Exposition. They also supplied electric locomotives to the London Underground and electrified Grand Central Terminal in New York in 1904. GE was involved in the production of gas-electric passenger cars in 1906. This was suspended during World War I and not picked up again after the War. In an effort to develop adequate prime movers, GE consulted with the primary source, Herr Rudolph Diesel. By 1918, GE built steeple cab diesel-electric's. The world's first diesel-electric switcher is generally considered to be the Central Railroad of New Jersey's unit, built by GE in 1924. It can be seen at the B&O Railroad Museum, Mt. Clare, Baltimore, Maryland

In 1934, GE began building the legendary GG-1 electric's for the Pennsylvania Railroad. 1956 marked the introduction of the Universal Line, referred to as U-boats. In 1958, GE produced the world's largest internally-powered locomotive for the Union Pacific Railroad, the 10,000-horsepower gas-turbine units. In 1962, GE moved the FDL diesel engine production from Cooper-

Bessemer’s plant to Erie. Also in that year, GE provided the monorail for the Seattle World’s Fair. GE provided the monorail cars to Disneyland and Disney World. In 1975, GE produced a series of E60C electric's for use on the NorthEast Corridor by Amtrak. In all, GE has a legacy of electric locomotives that stretches back over 100 years and more than 80 years experience with electric locomotives carrying their own generating station: the diesel-electric models.

GE production at Erie was 651 units in 1966. GE claimed a production rate of 26 days - start to finish - for a locomotive. The trend in maintenance contracts is to involve the builder in contract maintenance. This might be ‘coupler-to-coupler’ maintenance, performed by CSXT Shops, under GE supervision. The warranty contract might also specify a target unit availability. If the availability rate falls below the guaranteed rate then GE supplies additional locomotives to restore the rate. The additional locomotives usually come from the GE lease fleet.

Of note, the Fort Worth plant turned out two pink locomotives for the Roy Hill Mining Company of Western Australia in October of 2018. The color honors Chairperson Gina Rinehart, who is battling breast cancer.

National Railway Equipment Co.

The National Railway Equipment Company was founded in 1984 to supply new and rebuilt locomotives worldwide. They have units operating in Australia, Brazil, Cameroon, and the Ivory Coast, as well as for the U. S. Army. They have three models of a four -wheel, and 2 models of a 6-wheel arrangement. Their current series is the N-ViroMotive. These are efficient light-duty road switchers, with reduced noise and engine emissions. Up to three 700 hp prime movers can be switched in and out by computer control as required.

NRE Locomotive Manufacturing

NRE is the new kid on the block, using an innovative approach to motive power. They use the Genset concept for prime movers, in which several smaller diesels and generators are used in place of one large one. This has some advantages to reliability and emissions. It also allows the same engine, what whatever number are required, across the power range. They typically use Cummings or Cat diesels.

Using reporting mark NREX, NRE is headquartered in Mt. Vernon, Il. In addition to manufacturing, they also do rebuilds and leasing. Besides the U.S. Market, they have shipped locomotives to five other countries.

The NRE 2GS14B has twin Cummings QSK-19 prime movers of 700 hp each. They are 4-axle units. CSX has three of these, numbered 1317-1319 CSX.

The NRE 3GS21B has three of the Cummings engines in gensets. They are also 4-axle. The total generated power is 2,100 hp. CSX has 8 of these units, numbered 1300-1307.

Later, units 1304 to 1307 were modified to operate in electrified territory. This involved removal of the cab air conditioners due to clearance issues, and relocation of the air horns on the top of the cab. In addition, the battery boxes were moved inward on the frame.

Model NRE 3GS21B-DE has three gensets, and four axles. These units were numbered 1308 – 1316.

CSXT DC Locomotives

This section discusses the earlier DC locomotives used by CSX, mostly inherited from predecessor roads. A section later in the book will discuss the newer AC power models.

In 1986 and 1987, CSXT acquired no new locomotives. By 1988, CSXT began purchasing locomotives to augment the motive power fleet it had acquired from its predecessor roads. These new locomotives were delivered in the CSXT paint scheme and had no predecessor road's logo on them. They have included the SD60 and SD70MAC models from EMD and four models of the DASH-8 and two models of the Dash-9 from GE. In February of 1994, in a move to modernize motive power, the CSXT went on a buying spree, placing orders for 300 new locomotives, including 250 of the newer AC units. The railroad wanted to modernize its motive power fleet and use fewer, high-horsepower units to replace multiple units of an earlier generation - a tactical move referred to as *unit reduction*. CSXT ambitiously hopes to achieve a 2:one replacement of the old units with the new AC units. Unit coal and merchandise trains can now be seen headed with a single AC unit. The average per-unit horsepower rating of the CSXT fleet had exceeded 3,000 by September of 1997.

DC motors were the only choice for the early locomotives. They are operated in series-wound or parallel-wound mode, depending whether the brushes are in series or parallel with the windings. The windings create a magnetic field, and the brushes deliver power to the rotating core. This requires brushes, made of carbon/graphite, and a slip-ring assembly. The brushes were always a problem, and a wear-item. As they wore, the graphic dust got into everything.

Most electric motors on locomotives were series wound. Westinghouse was the major suppliers of motors, the same Westinghouse that invented the airbrake. Speed control was rudimentary, with resistances being switched in and out to control current. This was done with relays, which were another wear item. Today, the advances in solid state electronics allow for devices that can handle the hundreds of amps involved in field switching. These are reliable, unless they are overloaded. DC systems are actually better in heavy load situations, with start-stop operation. Series wound motors have a problem with wheel slip, when the motor speeds up to a run-away point or mechanical failure of the motor. As the wheel slips, the effective coefficient of friction between the steel wheel and the steel rail decreases rapidly, leading to a run-away situation. Yeah, we can put sand on the rail, but by this time, it is usually too late. Maximum adhesion (of the wheel to the rail) occurs just as slip occurs, but usually the motors are operated with a margin of safety. As electronics advance, wheel-slip has improved to operate closer to the theoretical point. This involves modulation of the current to the motor, not just a steady state. (This is something like the anitlock brakes/traction control in cars.)

Tractive effort is calculated by multiplying weight on drivers by adhesion. Adhesion goes to zero when the wheel is spinning, thus so does tractive effort. Adhesion is the coefficient of friction between the wheel and the rail. For clean, dry rail, this is usually around 0.40. First generation units had adhesion around 20%. Modern units with active adhesion control achieve 25% or better. The latest AC units with advanced traction control can achieve 39%

AC motors replaced DC motors when the state of the art in high-current electronic switching devices evolved.

The following sections discuss CSXT's EMD and GE purchases with direct current (DC) traction motors. The next section will discuss the theory and practice of the alternating current (AC) motored units.

EMD DC Locomotives

All of the EMD locomotives purchased by CSXT from EMD are of the six-axle (C-C) wheel arrangement and classified as *SD*. The SD series stands for *Special Duty*. These units have more available tractive effort than the earlier *General Purpose* (GP) models, but at the same, or less, axle loading. Units with B-trucks, or two-axles, can handle tighter curves than C-trucks with six-axles. With the newer steerable C-trucks, this is becoming less of an issue. New road units are now exclusively C-truck. The older four-axle units will find employment for many more years, however.

Tapered dynamic brakes are standard on EMD units, with flat mode as an option. Normal dynamic brakes on a DC motored unit operate down to about 25 mph, below which they become ineffective. The braking force is dependent on speed. The prime-mover driven generator is used to provide field excitation for the motors. The generated power is dissipated via roof mounted resistor grids, with fans. Optional extended-range dynamic brakes operate down to six mph or so. The throttle is used to control the degree of braking. In flat mode, the retarding force varies with the throttle position directly. Tapered mode was the original design. Here, the throttle position sets the maximum force and the braking actually depends on the wheel speed. The flat mode became standard around the year 1973. Dynamic brake systems on AC traction motored models operate differently, as will be discussed later

EMD SD-38

This was a 6-axle road switcher model, developing 2,000 hp from a non-turbocharged engine. The “-2” model had modular electronic control systems, and the HT-c trucks. CSX's unit's came from Conrail, although they were originally purchased by the Penn Central. CSX got 13, where Norfolk Southern got 21. The -2 models came from Seaboard, originally purchased by Louisville and Nashville. All but two of the CSX units are retired. There were also three of the SD38-2S model. Only two of the -S models remain in service, and none of the others.

SD-40

The SD-40 is a 6-axle road switcher, built from 1966 to 1972. It used the 645 engine, giving 3,000 horsepower from a turbocharged

V-16. Theses units saw service in the United States, Canada, and Mexico, as well as Brazil, and Guinea. The Brazilian gauge is 5 feet, 3 inches.

The SD-40's were built at McCook, IL. They used 40 inch driver wheels, and were a total of 65 feet, 8 inches long, ten feet wide, and a little over 15 feet tall. They weighted in at 360,000 pounds, with a fuel capacity of 3,200 gallons, 243 gallons of lubricant, and 295 gallons of coolant. The sand box reservoir held 56 cubic feet. They were equipped with the AR-10 alternator with D-77 traction motors, and dynamic brakes were an option.

Quite a few SD-40's came to CSX from predecessor roads, B&O, C&O, CRR, L&N, and WM.

SD40's got rebuilt as SD40-3's. These had a computer-based control system. This improved traction control, and fuel economy.

SD-40-2

The SD40-2 was a 6-axle, 3,000 horsepower road switcher form EMD. It was introduced in 1972, and its reliability and versatility lead to its being the best selling model in EMD history. The last delivery in the U.S. was 1984. It continued to be delivered to Canada, Mexico, Brazil, Yugoslavia, South Korea, Morocco, Peru, Pakistan, and Iran.

SD40-2's easily have a 50-year life. The -38, -39, -40, and -45 models shared a common frame.

They used the EMD 16-645-E3 prime mover with the AR10 alternator, and six of the D77/78 traction motors. They could achieve 65 mile per hour, and a tractive effort of over 83,000 pounds. The EMD-645 series diesel prime mover comes in V6, -8, -12, -16 and -20 configuration, in a 45 degree angle between banks. The displacement ranges from 5,160 to 12,900 cubic inches. It was in production from 1965 through 1983, with a few made in the 1990's

CSX predecessor's using the SD40-2's included B&O, Clinchfield, Seaboard, Conrail, L&N, and SCL.

The SD40-2R model, CSXT 8900-8911, is an upgrade. CSX got these models from Norfolk Southern. There is a rumor that, for a while, they were operated in their black paint, with “CSX” on the cab, before they were repainted. These were, essentially, SD40-2's with updates to DASH-2 specs.

SD40-3

This designation is for a CSX-rebuilt SD40-2. There may be a total of more than 300 that received this treatment. The goal is to gain an additional 30 years of service life. They got upgraded cabin heating and cooling, better safety protection, and a modernized braking controller. The engines retain their original horsepower rating, but tractive effort increased from 86,000 to 130,000 pounds.

Units from different predecessors have different options. Some have the HT-C trucks, where ex-Conrail units have Flexicoil. A few SD40-3's started life as SD-40's. Conrail also had rebuilt an SD45-2 to SD40 specs. That is now CSX unit 8886.

The SD33ECO is a SD40-2 re-power with a EMD 12-710 prime mover. It meets Tier-3 emissions. This rebuilt was applied to some ex-SBD units. A re-power results in the SD40-E3, with a new cab as well, with electrical and mechanical updates.

F40PH-2

There were eight of these units in service with CSX from 1978 through 1980. These were ex-Amtrak units 390, 395, 280, and 288.

CSX still has some of the ex-Amtrak units, to pull executive cars. The passenger locomotives provide electrical power to the cars. Some can provide steam heat.

These are 4-axle, 3000 EMD units. They are essentially GP-40-2's. Unit 9998, in service, was recently repainted to the YN3b scheme.

SD50

The SD-50 is an EMD road-switcher, rated at 3,500 horsepower. It first appeared in 1981, and was the last model without microprocessor control. It used an updated version of the 645 prime mover, in a V-16 format. The units were unfortunately plagued with problems with the prime mover and the electricals. The 645F3 engine was stressed in its 3,500 horsepower form. Derated units (to 3,000hp) were designated as “dash-2's”.

Units originally purchased by B&O, C&O, Conrail, and Seaboard went into CSX service.

SD60

These units were the first to be purchased directly by CSXT from EMD, not inherited from a predecessor road. They feature microprocessor-based electronic control of prime mover and locomotive functions. Over 500 units of this type were produced by EMD from 1984 to 1991. The CSXT units were built near the end of 1989. The SD60 demo units EMD-1, -2 and -4 were working coal traffic out of Cumberland, Maryland, in October 1985.

The prime mover of the SD60 is a 3,800-horsepower, 16-cylinder, type 710G diesel driving an alternator. This was the first use of the 710 prime mover, which is derived from the earlier 645 model. The units carry 4,900 gallons of fuel and use a 70:17 gear ratio. The SD60 is visually similar to the SD50 models. They are a few inches over 71 feet long. The EMD *Super Series* wheel-slip detection system allows controlled wheel-slip at speeds above 1.5

mph, to enhance traction. The disadvantage of this technique is increased wheel wear. The *Super Series* supersedes the IDAC wheel-slip control system. The units weigh 390,000 pounds. Maximum continuous tractive effort of 96,300 pounds is achieved at 9.8 miles per hour.

The SD-60's are equipped with an onboard computer and a display/keyboard for the engineer. Dynamic braking provides up to 80,000 pounds of retarding force, down to 10 miles per hour.

There are several forms of dynamic braking. The plain vanilla form is where the original dynamic brake that gave its highest retarding force (700A) at 23mph. Above 23mph it is limited by brake grid amp rating, and below 23mph it is limited because motor armature speed is low. The braking force developed was dependent on speed and throttle position.

Extended range dynamic brakes generate their highest retarding force between 6 and 23mph because circuitry and contactors have been added to shunt away some of the the dynamic brake grid resistance, allowing more current to be developed at slower rates of motor armature rotation. The force developed is then dependent on Throttle position only.

With flat control the dynamic force generated is varied by the position of the throttle only. Flat control was designated as Standard by the AAR.

Taper control was the original design for the original dynamic brake. The maximum retarding force was governed by the position of the throttle and the speed of the loco. The retarding force developed by a certain position of the throttle would vary with the speed of the loco. This caused a lot of problems.

Taper control was also incompatible with the switchgear used for the extended range dynamic brake. Flat control was needed to snub braking current surges that occurred when grid shorting contactors would pickup or dropout on the extended range dynamic brake.

The flat system became standard around 1973 and most new locos after that were so equipped. If it had extended range dynamics and was flat control. If it had standard range dynamics, if it was older than an SD-40, it could have taper system, if it was SD-40 or newer it had Flat system. The speed you were moving had an effect on the amount of retardation. The taper system generated the same for all notch position, regardless of speed. Since most loco consists are made up of different locos and systems, we haven't even looked at mixing locos in a consist with different taper and flat units.

Ten SD60 units were bought by CSXT in 1989 and remain in service in 1998. These units are numbered 8700-8709. There were reported maintenance problems with the units, which turned up during heavy service. CSXT will probably double the size of their SD60 fleet with units acquired from Conrail. These will be renumbered starting with 8710.

Also, a series of SD60I models became part of the CSXT fleet after the acquisition of Conrail. One of these (Conrail 5544) has the isolated *Whisper Cab,* the same as the SD80MAC models. This features special isolation mounts for the cab assembly and a more ergonomic and safety interior design. Integrated cab electronics (ICE) was also a common feature on Conrail SD60 units and they had 4,400 gallon fuel tanks. CSXT got more than 30 of these models, to be renumbered into the 87xx series. In addition, a set of Conrail’s SD60M models came to CSXT.

The SD-60m has the North American Safety Cab. Conrail purchased some of these units.

By the time this book was being completed, CSX had sent two of the SD60's to the Pennsylvania Northeastern, operating north of Philadelphia. Nineteen more went to Progress Rail. Two of the

Sd60I's went to Metro East Industries in St. Louis, and 20 went to Progress Rail.

Of the SD60M's, six went to the Yadkin Valley Railroad (North Carolina, four went to the Lancaster and Chester (South Carolina) and four went to the Knoxville and Holston River Railroad (Tennessee).

What remains in CSX service are 4 SD50-2's, 1 SD60I, and 10 SD60M's. All of the SD60's are gone.

GE DC locomotives

This section discusses CSXT's DC locomotives from General Electric.

GE Dash-8

The GE DASH-8models are considered to have a very good wheel-slip detection and control system. These locomotives control slip at the axle level and use DC traction motors.

The concepts for the Dash-8 series were tested on the B36-8 model in 1982, particularly microprocessor-based control. The Dash-8 models, introduced in 1984, also feature electronic fuel injection and split cooling systems for the prime mover. The visually distinctive high-winged radiators make for easy identification of these models on the road. They also introduced the extensive use of modular, microprocessor-based electronics to allow for real-time diagnostics and rapid problem isolation, diagnosis, and repair. High-adhesion trucks are used, achieving a 28 percent adhesion factor. The air compressor, radiator fan and equipment blowers are engine driven. The venerable FDL prime mover, with a bore of nine inches and stroke of 10.5 inches, uses a compression ratio of 13:1. The prime mover is turbocharged and has an intercooler. Starting with the Dash-8s, a radar unit is used in the wheel-slip control system to measure locomotive ground speed. In October

1988, CSXT purchased 50 of the Dash-8 models. First produced in 1985, over 1,000 units had been built by 1990. Dash-8 production ended in 1994. CSXT has four different examples of the Dash-8 model line on the roster.

C40-8

This model was introduced by GE in 1987, and dubbed *TechnoToaster*. The C40-8s were purchased new by CSXT, with the first being delivered in June 1989. In April 1990, CSXT ordered 53 more of these units. They are numbered in the range 7500-7646. Units in the second delivery group came into service at the end of 1990 with road numbers in the range 7594-7646. These units were equipped with flange oilers, a feature on all subsequent units. CSXT got ten or more C40-8 units from Conrail, renumbered starting with 7489.

The C40-8 model had several improvements over the B36-7s. The C40-8 is equipped with a Diagnostic Display Panel, driven by the locomotive onboard computer. In addition, the air compressor on the C40-8 models is driven by a separate electric motor. The prime mover is started by using the locomotive batteries to supply current to a bank of inverters to power the traction alternator in reverse as a motor.

The second group of locomotives was essentially identical to the first group, with several minor changes. The electronic fuel meters were eliminated and an improved air flow indicator was fitted.

CW40-8

These units were purchased by CSXT in 1991 through 1993. They were numbered in the range 7650-7917 and feature the wide or comfort cab. CSXT unit 7770 was sold to the same as for the regular-cab

C40-8

The GE designation for this model is Dash-8-40CW. Units 7754-7758 were the first units ordered with ditch lights, which have become a standard feature for safety. They were also the first units to apply the 752 AH traction motors with roller bearings in place of the 752AG models with friction bearings. Although the move to roller bearings in wheelsets was made some time ago, the use on traction motors is a more recent innovation.

Unit 7812 was renumbered *1992* when it was used as the special engine for President Bush’s campaign train that year. It has since been repainted and numbered 7812 again, but it once sported large presidential seals and American flags on the sides. It was temporarily named the *Spirit of America,* and still carries that designation. It is currently in storage in Waycross, Georgia.

CW40-8B (B40-8)

Twenty of these units were transferred from the New York, Susquehanna & Western (NYS&W) to CSXT, which had financed them. They were renumbered to 5930-5949. The predecessor road had given them the even numbers from 4010 through 4048. This B40-8 model was the basis for Amtrak’s *Genesis* passenger locomotive. The CW40-8B's were acquired by CSXT in 1986-1988.

They were equipped with 3,900 gallon fuel tanks and weighed in at 288,000 pounds. They used the 83:20 gear ratio. Up to 54,200 pounds of retarding force is available from the dynamic brakes, down to 10 miles per hour. Locomotive operation is microprocessor-based, with a display and keyboard for the operator. The computer also provides active adhesion control. The 16-cylinder engine is rated at 4,000-horsepower.

C40-8W

The “W” version indicates wide cab configuration. More than 750 examples of this class were built. Many went to Conrail, and wound up at CSX. The later models split the cooling systems for the engine, and for the turbo intercooler. Models delivered to Conrail after 1993 had an Integrated Function Display in the cab.

C40-9W

These units were derated from 4,400 to 4,000 horsepower. This includes numbers 9000-9002, 9003-9052.

C44-9W

These units were purchased new by CSXT and are numbered in the range 9000-9052. CSXT chose to classify these as CW44-9. GE calls them Dash-9-44CW. They feature an upgraded 4,400-horsepower, 16-cylinder 7FDL prime mover. The first CSXT units, road numbers 9000-9003, were prototypes built on a Dash-8 frame. These units were 2 feet and 4 inches shorter. Later production units had the lengthened frame, as well as a different arrangement of steps and no rear number boards. The first three units joined the CSXT roster in 1993 with the additional units coming onboard in 1994. Plows and ditch lights are standard on these units, as are toilets located in the short hoods. These locomotives have the desk-type console in place of the control stand, but retain the analog gauges and do not have the computer display screens. CSXT stands to get a dozen more of these units from Conrail, to be renumbered into the CSXT scheme, beginning with the road number 5950.

Some of these units, ex-Conrail, were sold back to GE. Others went to LTE. Units 7771 and 7801 were converted to C40-8WM's (Canadian models). Units 7761 and 7815 were wrecked and subsequently retired. CSX considered 9003-9052 as C44-9W.

Depending on how things got rebuilt and renamed, there are no longer any C44-9W's on the roster.

The Wabtech QES-III Locomotive computer

This embedded computer product from Wabtec is both EMD and GE compatible. Wabtech is now merged into GE. The computer includes a 15 slot rack, which houses the computer, memory, and I/O boards. The system is designed to operate from the standard 74 volts dc power found in modern diesel locomotives. Memory includes up to 2 megabytes of battery backed RAM, up to 1 megabyte of scratchpad ram, and up to 1 megabyte of flash memory for program. It communicates with a laptop over an RS-232 serial line, and with locomotive control and monitoring modules using RS-422 protocol (synchronous serial).

The computer system replaces older relay-based control equipment. It monitors and controls battery charging, the blower motors for cooling, dynamic braking, the main generator field current, and the traction motor current. It samples water temperature, air temperature, and air brake pressure. It keeps track of hours of use, mileage, and horsepower-hours, which is a billable quantity.

The associated High Voltage module measures 0-1400 volts from the main generator. The Traction Motor Current module measures 0-1500 Amps. The Dynamic Brake current module measures 0-1500 amps for the dynamic brakes. Many other interface modules to locomotive equipment are available.

The functions implemented include main generator excitation control in power and dynamic braking modes, wheel slip control, control of engine cooling, sensor tests, and diagnostic monitoring.

It also includes an event recorder function, and logs anomalies and tracks required maintenance by hours of use.

The computer is responsible for the operation of the 6,000 horsepower diesel, the associated a/c alternator, and the 6 traction motors, which are controlled independently. Active traction control is used to prevent wheel spin. The computer also does monitoring and diagnostics, and can “phone home” to report impending problems or maintenance issues.

AC Locomotives Primer

Locomotives with alternating current (AC) traction motors are significantly different from those with direct current (DC) traction motors. The combination of the diesel-driven alternator, traction motors and electrical switching, along with engine speed control, can be thought of as the locomotive's transmission. This system matches the output of the diesel prime mover to the tractive effort required to move the load on the rails. As prime mover outputs move to 6,000-horsepower and beyond, the use of AC traction motors is required.

The use of AC motors and alternators was enabled by the development of solid-state electronic switches that could handle the large voltage and currents involved, as well as work in a hostile environment of a moving locomotive, with excessive heat and vibration.

In an AC unit, the prime mover turns an alternator at a pre-selected and controlled constant speed. The alternator produces alternating current, which is rectified to direct current. The direct current is then transformed back to AC by solid-state units called inverters. The development of AC diesel traction depended upon the development of solid-state inverter systems that could handle the power involved.

Why convert the AC to DC and back to AC again, with all of the inherent conversion inefficiencies? The answer lies in the nature of the prime mover-alternator system and of the traction motors. The prime mover-alternator system is operated by the engine control system at a constant, pre-selected rpm rate, depending on the engineer's selection of a throttle notch. At this rpm, the alternator produces a certain frequency of AC. If this were directly applied to the traction motors, they would operate very inefficiently, because they would attempt to synchronize with the alternator and operate at a constant speed. This would make it difficult to accelerate without slipping and difficult to accommodate varying loads. Simply changing the applied voltage with a transformer is not the answer either.

The key to AC motor control efficiency is to tailor the applied excitation waveform to the load. This is not really possible with DC motors - we can only change the applied voltage. With an AC motor, we can change the applied voltage, frequency and phase of the signal. That's what the inverter does. The main alternator is happy running at a constant speed, producing power at a certain AC frequency. We customize this waveform with the inverters and apply it to the motors, changing the characteristics of the applied waveform to accommodate the load and thus maintain efficiency. No stall burns are possible in the AC motor and the short-time ratings common to DC motors are eliminated. There are also no reversing contactors, as reversing is controlled by the phasing in the inverters.

These three-phase AC induction motors are smaller and lighter than equivalent DC motors and they generate less heat when running. They have no commutator brushes, a major maintenance item. Because of this, they are less susceptible to vibration damage. AC-motored units don't need slow-order restrictions at cross-overs, for example. Jarring caused by moving through rail cross-overs in yards and rough track can easily crack the brush assemblies in DC motor assemblies, but don't affect the AC units. The AC traction motors have sealed bearings and are rated for 1,000,000 miles of service before overhaul.

The permanent magnet synchronous motor used in locomotives generally is a 3-phase unit. There are permanent magnets fixed in the rotor. A rotating magnetic field in the stator windings cause the rotor to rotate in synchronism. The magnetic field rotation is about 1% faster than the wheel rotation. This requires a complex control system, but that is easily implemented in current electronics. The stator is sealed, and has integral liquid cooling. Rotor cooling is not required. The permanent magnet motor is smaller than its counterparts. Advanced control systems control both torque and speed. The PM motor offers higher starting torque than induction motors. The electric motors are able to supply maximum torque at zero RPM, just when it is needed.

Advanced electronics provides weight transfer compensation for advanced adhesion. Under load, weight transfers from the front axle to the rear axle in a truck. In an AC system, when the front axle is moving faster than the rear in a truck, power to that axle is reduced.

Dynamic brakes on AC units operate differently from those on DC units as well. They can be used down to 0 mph and, in fact, can be used to hold a consist on a hill. Try this with a DC-motored unit and the motors will quickly melt. The AC unit can be held by reversing the motor and providing a slight amount of backdrive. This method can't be used indefinitely, as the motors still get hot.

On AC motor units, the dynamic brakes will still operate even with one or more traction motors disabled or isolated. DC motor units are usually operated in series with the dynamic brakes and are restricted from being operated in dynamic braking mode with any motors cut out.

The function of the transmission as used in cars with gas or diesel engines is provided by the generator and the electronic controls in a locomotive.

A major desire is to be able to mount the traction motor directly on the wheel, not geared to the axle. This has not yet been successfully achieved.

Wheel slip is a problem, and is addressed by modern sensors and controllers. Besides measuring wheel rotation rate directly, doppler radar is used to measure speed over the ground. A simple comparison in the controller tells if the wheel is rotating faster than needed for forward progress. This is then adjusted.

Development continues on hybrid engine technology for locomotives, which has been successful in passenger cars, but we're not there yet in heavy haul. T he use of biodiesel has been considered and tested, but engine manufactures are still unsure how it affects engine life, and thus the cost of your warranty.

Advanced technology's including computer control is adding to locomotives efficiency. The locomotive can link to its diagnostics and service facility in case of by radio a warning or fault. More and more software is required in the locomotive's onboard computers. It has been said that software is the ideal component – it doesn't weigh anything. Software does have its own quirks and failure modes that have to be considered.

Engineers have been re-qualified on the new AC units and mixed consists of AC and DC traction power are possible but not desirable, due to the different operating characteristics. AC locomotives are distinguished on CSXT by a lightning bolt on the cab side, near the unit number.

CSXT's AC Locomotives

This section will discuss the AC locomotives of CSX. GE, EMD, and NRE all supply these more modern locomotives.

EMD AC Locomotives

This section discusses the AC locomotives from EMD, in the CSX fleet.

SD70MAC

The SD70MAC was first demonstrated to CSXT in the Cumberland in April 1993. Twenty-five units were ordered by CSXT in July 1996, for delivery starting in 1997. All twenty-five were at work in early 1999 and were numbered in the 700 series. Their initial assignment was on CSXT's Cumberland Coal Business Unit. This was the first order from EMD by CSXT since the 10-unit SD60 purchase in 1989. The primary new feature introduced on the SD70MAC is the use of AC traction motors and this model is the first production AC traction locomotives by EMD. Wheel-slip is more easily controlled and a higher starting adhesion is achieved, because the motor is controlled by both applied voltage and frequency. Conventional wheel-slip control systems with DC traction motors are capable of achieving a 25 percent adhesion factor. The SD70MAC's AC motors achieve a 33 percent adhesion factor. The higher the adhesion factor the better, as this represents the percentage of the locomotive's weight transformed into tractive effort for pulling loads. The AC traction motor is the way of the future, because more of the locomotive's weight can be turned into useful drawbar pull.

The SD70MAC units also have GM's HTCR^{tm} self-steering radial trucks. These minimize friction on three-axle trucks, by allowing the individual axles to steer into curves. This feature allows the operation of six-axle locomotives on territory previously restricted to the less powerful four-axle units. The HTCR truck controls weight transfer during acceleration with a bolsterless design. These trucks have oil-filled gear cases, and use 42-inch wheels.

Maximum speed of the SD70 units is 75 mph and they are rated for a starting tractive effort of 175,000 pounds and a continuous rating of 137,000 pounds at 9.2 mph. Grade C drawbars and draft gear in common usage are rated for 260,000 pounds working, 360,000 pounds yield. Using more than two of the SD70MACs on the front end of a heavy drag may result in broken couplers. The newer

Grade E parts are rated to 360,000 pounds working, 500,000 pounds yield. Besides this, the solution to broken couplers is to use rear-end and possibly mid-train helpers on heavy grades such as the B&O *17 Mile,* on the way west to Grafton, West Virginia.

In the radial truck, the first and third-axles are mechanically coupled and the middle-axle can move laterally. This allows a degree of steering around curves, not found in rigid three-axle designs.

The SD70MACs entered production in 1993. They use the 4,000-horsepower, 16-cylinder, type 710G3B diesel prime mover. The bore is 9.1 inches, with a 11 inch stroke. The unit is two-cycle and uses electronic fuel injection and turbocharging. The intercooled turbocharger boosts the input air pressure to 27 pounds per square inch. The engine peaks out at 950 rpm and weighs 43,000 pounds. The SD70MAC locomotives weigh 415,000 pounds, are 74 feet long, 15 feet, nine inches high and just over ten feet wide. They carry 436 gallons of lubricating oil, 276 gallons of cooling water and 72 cubic feet of sand. Standard 42-inch diameter wheels are used. The main alternator is type TA-17 and the traction motors are a Siemens design. A 85:16 gear ratio is used. Dual EMDEC microprocessor units provide fuel injection control, under direction of the EM2000 locomotive control computer. Microprocessor monitoring and control of the air brake system is also employed. The 5,000-gallon fuel tanks are of an impact-resistant design, to resist puncture and spilling of the diesel fuel, which has become an environmental issue. There are three 48-inch diameter, 5-bladed cooling fans for the main radiator.

The CSXT units feature the WhisperCab^{tm}, a modular, isolated structure designed to provide crew comfort and protection and a controlled environment for the computer electronics. This cab features desk top workstations for the engineer and conductor. Dual color liquid crystal display (LCD) screens on the operators desk are used for cab functions. The display screens, part of the

Rockwell-provided Integrated Cab Electronics (ICE), replace gauges and lights on conventional older units. The flat screen display shows throttle position and tractive effort (or dynamic braking effort), fuel quantity, air brake system parameters, End-of-Train information and operating modes and alarms. It interfaces with the EM2000 microprocessor controller. Collision posts are incorporated into the cab design to safeguard the crew.

Unit 700, named *Spirit of Cumberland,* was christened by Maryland's lieutenant governor, Kathleen Kennedy Townsend, at a ceremony to honor the railroad's contribution to the City of Cumberland's economy in October 1997.

Siemens electronics are used for control of the AC traction system. In the EMD design, there is one inverter per truck (three traction motors), using inert fluid for cooling in place of forced air. Individual traction motors cannot be cut out in case of a fault, but a truck (three traction motors) can be isolated, resulting in 60 per cent less available tractive effort and dynamic braking. The SD70MACs have been in production since November 1993. The SD70MAC is the first of the AC traction motor units, which have become standard for high-horsepower usage on locomotives.

CSXT was making use of a variety of leased EMD SD70MAC units in 1997 and 1998 and inherited fifteen of these units from Conrail. In early 1998, Conrail's Shops in Altoona began assembling SD70MAC kits, received from EMD. One of the conditions of the Conrail purchase of the SD70 models was that some of the work would be done at the Conrail Shops. Both SD70MAC and SD70 DC units were ordered. The AC units went to CSXT after the consummation of the merger, with the DC units going to Norfolk Southern. In the early part of 1998, the SD70MACs were outshopped from Altoona in Conrail paint, with road numbers 4130 through 4144. These were built to CSXT specifications. Post-merger, these became CSXT 725 through 739. The last unit left the shop floor by May 1998. NS units will have the spartan cab and will be signaled to operate on the North East Corridor. CSXT calls the SD70MAC models *SD70AC*, due to a six-letter designation field limitation in the CSXT computer system. The SD70MACs are equipped with Leslie 5-chime horns.

Some units went to Four Rivers Transportation, now, P&L Transportation of Wilmington, Delaware.

SD70MAC's from Altoona

CSX	Conrail	Builder Number
725	4130	47530
726	4131	47531
727	4132	47532
728	4133	47533
729	4134	47534
730	4135	47535
731	4136	47536
732	4137	47537
733	4138	47538
734	4139	47539
735	4140	47540
736	4141	47541
737	4142	47542
738	4143	47543
739	4144	47544

SD70ACe-T4

As of Fall, 2018, CSX ordered 10 of the SD70ACe-T4's. These are the first loco's to meet Tier-4 emissions requirements. They will carry the CSX numbers 8900 through 8909. They are to arrive in early 2019. There are built in Muncie, Indiana.

They feature a new 4-stroke prime mover, the EMD 12-1010, "J" series. This is a V12 with 1010 cu .in. displacement for each cylinder, or a total of 12,000 cubic inches. It has a two-stage turbocharger system consisting of three turbos; the primary/high pressure turbo for low-mid range RPM and two secondary turbos for mid-high range RPM. This gives more power through a wider RPM range, while at the same time increasing fuel economy and lowering emissions. Exhaust gas re circulation is also used for controlling emissions. The unit is rated at 4,400 horsepower.

Unlike previous models that have one inverter per truck, this model features one inverter per axle. It has the new style radial bogies, and software updates for Individual axle control. The powertrain is vibration-isolated. The cab has been redesigned for comfort and safety.

The SD70ACe-T4 can generate 200,000 pounds-force at start, and 175,000 pounds-force continuously. The starting force is equal to that of the 6,000 horsepower SD90-MAC-H, while the continuous force is greater. The dynamic braking maxes at 105,000 pounds-force. Union Pacific has been using these units since November, 2016.

SD80MAC

The SD80MAC uses a 20-cylinder version of the 710G3B-ES engine to achieve 5,000-horsepower. The earlier attempt by EMD to stretch a 16-cylinder engine to 20-cylinders (the 645 model from the SD40 into the SD45) met with mixed reviews. The advantage of the added horsepower did not offset the increased maintenance headaches and increased fuel consumption of the added-cylinders. The Conrail experience with the SD80MACs was favorable. This unit may well represent the peak development of the two-cycle 710 engine, derived from the 645 and reaching back to the original 201 design from Winston in the 1930's. A dual-independent split cooling system is used. One part services the heat load of the prime mover and lube oil, while the other handles the turbocharger intercooler and air compressor. The systems are linked and engine cooling takes precedence over intake air cooling by design. Large radiator wings give this EMD unit a GE-like appearance. One way to distinguish the big EMDs from the big GEs is the door on the nose; EMD units have a door on the right, while GE's door is placed on the left. Electronic fuel injection via the EM-2000 computer system will maximize power while optimizing fuel consumption and minimizing pollution. The EM-2000 computer is based on the Motorola 68020 32-bit microprocessor. It communicates with dual traction-control computers via serial data lines. The traction-control computers are each responsible for three traction motors. These computers are based on the Intel 80186 16-bit microprocessor. Heat from dynamic braking is vented off by a 52-inch diameter fan; the three cooling system fans measure 48-inches in diameter.

With the Conrail merger, most of the SD80MAC's came to CSXT. They were renumbered into the 800 series. Norfolk Southern, the other partner in the Conrail merger, had no AC units in its fleet in 1998, but took some of the Conrail SD80 units for evaluation.

The Conrail SD80MAC units had the air-conditioned Whisper Cab and use the HTCR radial trucks. These have a major advantage in steering through curves, reducing both rail and wheel wear. These are equipped with rather large 45-inch wheels. The trucks are equipped with a flange lubrication system. The HTCR trucks are designed to go one million miles between overhauls and allow the AC motors to achieve a 35 per cent adhesion factor.

The SD80MACs use EMD's Integrated Cab Electronics (ICE), with the American Association of Railroads (AAR) screen format. These display tractive effort meters on the in-cab screens, along with throttle position and air brake status information. The ICE also enables a feature called *Distributed Power*, which allows unmanned operation of a unit for mid-train or rear-end helper service. This is accomplished via radio link. ICE also allows the use of electronically activated air brakes (with suitably equipped cars). The SD80MACs do not have an external handwheel-activated parking brake. In the cab, on the engine control panel, a control electrically operates the parking brake. A manual backup activation feature is available. Leslie RSL-3L-R air horns are fitted on the long hood, centered and ahead of the radiators.

Conrail rostered 28 of these units, referred to as the *Conrail Cadillac's* and numbered 4100-4127. These units were two inches over 80 feet long and carried 5,800 gallons of fuel, 510 gallons of lubricating oil, 342 gallons of coolant water and 40 cubic feet of sand. They achieved a continuous tractive effort of 147,000 pounds. Usually, the SD80MAC units were operated in pairs. In operational service, four units could pull a 200-car loaded ore train.

Pleased with the performance of these units, Conrail bought EMD demonstrators 8000 and 8001, which became Conrail 4128 and 4129. An additional order for thirty units was modified in light of the Norfolk Southern/CSX/Conrail merger. Unsure about the SD80MACs and with no experience with this model, CSXT had the order changed to the SD70MAC model. These were built at the Altoona Shops from EMD-supplied kits and were numbered Conrail 4130-4144 in the interim. These were completed in the Spring of 1998. The other half of the order was for DC-model SD70s for Norfolk Southern, also constructed at Altoona. CSX has no SD80MAC's on the roster currently.

SD89MAC

The SD89MAC has a 4500 horsepower engine. Only one was ever built, and none were ever sold, customers opting for the SD90. The SD90MAC has the new 4-cycle, 16-cylinder, 6,000-horsepower prime mover. This 16V265H model is a radical departure for EMD, which, since its inception, has used 2-cycle units. The new engine features air-start, has dual turbochargers. SD90MAC units, called *convertibles*, were being shipped to Union Pacific with the 4,300-horsepower prime mover from the SD-75 model, with provision to swap out the engine when the larger model becomes available. They became available with the release of the two EMD demonstrators GM90 and GM91 in the summer of 1998. These were painted in an all-white scheme, with red frame stripes. These are classified SD90MAC-H. CSXT is evaluating these units for application in their own heavy haul operations. The service interval for the SD90MAC is designed to exceed the 90-day norm, to 122 days.

The cab displays use the color LCD screens, driven by 32-bit microprocessors. The EMD *Expert* diagnostic system is used for troubleshooting problems.

The SD90MAC is over 80 feet long, and maintains a 15 feet, 8 inch height to the top of the fans, for tunnel clearance. It uses 45 inch wheels, with a final gear ratio of 83:16. It achieves a 200,000 pound starting tractive effort, 170,000 pounds continuous. The maximum braking effort is 115,000 pounds. The units weigh about 425,000 pounds, and achieve an adhesion factor of 38%. The SD90MAC carries 5,800 gallons of fuel, 420 gallons of lube oil, and 305 gallons of -- antifreeze. This is also a radical departure for these larger engines. Prior to this, the engine cooling systems used water only, and had to be drained in freezing temperatures when the prime mover was shut down. With improved materials in the cooling systems, and improved formulations of antifreeze, the use of the coolant in modern high-horsepower road units is feasible.

The 265H prime mover is designed to reach 8,000-horsepower with 18- or 20-cylinders. But again, CSXT and other roads are comfortable with 16-cylinder units and may not accept these larger, more complicated units for some time.

CSX 629, formerly one of the 6,000 hp double lightning bolt locomotives, has been demoted to working as a yard engine after having its horsepower reduced in 2017.

What's new at EMD?

CSX Transportation is using a Communications-Based Train Management (CBTM) system to improve the safety of its rail operations. CBTM is the predecessor to ETMS. GM's FIRE – Functionally Integrated Railroad Electronics and Intellitrain – ETMS leverages advanced technologies for locomotive optimization.

Intellitrain detects and diagnoses faults, and reports these directly to a support center (repair depot). There are 3,000 data points monitored. Some data are sampled at millisecond rates. The fault data is available on a secure website, or can be texted to designated smartphones.

There is an onboard network on the locomotive. Data is collected on equipment health, speed, location, fuel level, faults, and more. This is sent to a service center via cellular link, or satellite radio. GE has PinPoint and Expert-on-alert.

FIRE uses a network of three PC-104 bus embedded computers, running the Windows-embedded operating system. The operator displays show a dozen standard locomotive gauges, indicators, and controls. Everything is network-connected. There is a dedicated controller/monitor for each 3 axles.

The new locomotives are beginning to resemble networked computer complexes. Most of the functions are done by embedded computers, which continuously monitor the status of the entire unit. If they spot a pending problem, they “phone home” over satellite link to alert the maintenance facility. At the same time, data is collected continuously on performance, which can be helpful in anticipating failures.

The EMD Intellitrain solution links many operational tasks into one controller. The CleanIdle function can shut the engine off to save fuel and control noise, but restart it when it needs to maintain temperature. The Smart Consist function does advanced diagnostics. The pilot assist can access the throttle and dynamic brakes. Intellitrain Connect accesses the EMD control system via an ethernet connection, and critical updates can be downloaded by wireless. The system also includes an event recorder, and video recorder, somewhat like a plane's blackbox. The Integrated Objection Detection System uses cameras and radar to scan for potential collisions.

All of this infrastructure is built on inexpensive and very capable embedded computer board, cheap memory, and existing networking infrastructure. Embedded systems are not stand-alone computers, but rather “embedded” in a system they monitor and control. They may have little or no human interface. They employ a series of input/output industry standards, and standardized operating system and application software. Generally, power is not an issue, as the units only require a few watts of the thousands of watt going to the axle motors. Environmental control has to be watched back in the car body, but, in the cab, if you're comfortable, so are the computers.

Embedded systems are generally dedicated to a single task or small set of related tasks; have limited human interface; have special purpose interfaces; and are mostly self-contained.

Many embedded systems are required to be real-time - they have strict deadlines. Others are event-driven - a trigger event kicks off a predetermined sequence of responses. Embedded systems are almost always resource constrained. The resources might be size, weight, power, throughput, heat generation, reliability, deadlines, etc. Embedded systems have a high non-recurring engineering (NRE) cost (development cost), but are generally cheap to produce in volume.

In the automotive world, the latest models have more computers that the latest fighter jets. In fact, my last two services on my car were for “software updates.” Automobiles have become more efficient and safer, and so have locomotives. The embedded processors allow us to do things that were once impossible. You can think of the embedded processors as “black boxes,” that you have no idea what they're doing or how they do it, but the are another set of eyes on the job, keeping your back.

A microcontroller is a simple CPU plus some memory and input-output. The idea is to have a single-chip solution to minimize costs. Microcontrollers are not used as general number crunchers, but in dedicated control applications such as elevators, gas pumps, locomotives. There are specialized versions of microcontrollers that have the specific I/O interfaces you need. Specialized microcontrollers can do fast math as required. Microcontrollers also come with multiple computers in one package. This technology is now being applied to locomotives.

Some are optimized with specific vision software so they can detect and alert the operator when something is obstructing the track. Cars do that now, and alert you or put on the brakes by themselves.

GE's AC Locomotives

This section discusses AC locomotives out of Erie, PA. (up until 2019, where the manufacturing facilities were shifted to El Paso, Texas.

GE C40-8w

This was a 6-axle unit, built from 1990 to 1994. The “w” indicates the wide or safety cab. Some went to CSX directly, and some from Conrail. CSX disposed of some units to GECX, and these are still in lease service. The CSX unit numbers were 7300-7396, 7650-7917, and 7918-7929.

CSX had ten units of these rebuilt at Erie as C40-8WM's. They got new prime movers, an upgraded cab interior, an upgraded control system, and Positive Train Control. Shutters were added to the radiators to control engine temperature more accurately. These units had come through Conrail.

GE DASH-9

GE’s Dash-9 models were available as AC propulsion locomotives. These units feature a separate air-cooled inverter unit for each of the six AC traction motors. AC traction motors require no transition, providing for smoother starts and acceleration. The prime mover features electronic fuel injection and split cooling. Considerations for ease of maintenance and reduced fuel consumption are evident in this locomotive’s design. The electronics assemblies from GE-Harris Railway Electronics are modular and are designed for a two-hour maximum time to diagnose and repair problems. Fiber optic cable is used for communication on the locomotive, to reduce electrical interference from the inverters. A modern locomotive may use 50 or so microprocessors, from small eight-bit units for device control to 32-bit machines for vehicle control, coordination and displays. It is not unreasonable to find over 1/2 million lines of computer code running on those machines. The complexity of the modern locomotive rivals that of commercial aircraft.

AC4400CW

The 4400CW model was available from GE with AC or DC traction motors. Tractive effort is 118,000 pounds with the DC motors, 145,000 pounds with the AC motors and the HiAD^{tm} trucks. The CSXT models all have the GEB13A AC traction motors with 87:16 gearing and 42-inch wheels. The AC4400 was tested by CSXT in August 1994. In the Fall of 1995, three CSXT units went to the Burlington Northern for testing, in exchange for three Burlington Northern SD70MAC’s. The CSXT units ranged from Texas to Washington State, and the BN units saw service in

Kentucky, Florida, and Maryland. An option on these models is a self-steering truck, which CSX chose. CSX also ordered their units with 20,000 lbs of ballast, for extra traction. In addition, a software update to the controller added extra traction (and weighed nothing).

Pleased with the early AC4400's, CSXT ordered more of these units. There were 330 AC4400s working for CSXT in 1998. Some have been retired some converted to CW44AH models. Some were wrecked. They are valued at about $1.6 million per unit. They were originally numbered starting with 9100, but the numbering scheme was later changed to start with 1. Older units on the roster were renumbered to provide space for the ACs. These locomotives are used system-wide to replace multiple units of a lower horsepower rating.

These 4,400 horsepower units carry 5,000 gallons of fuel and feature an adhesion factor of 35 percent. They provide a 145,000 pound maximum continuous tractive effort at 9.9 mph. The maximum tractive effort reaches 180,000 pounds. The units are good for 75-80 mph with the 87:16 gearing. They are over 73 feet long and have cab air conditioning for operator comfort. Production started in June 1994. They are the first production diesel locomotive with AC traction delivered by GE to a U. S. common carrier railroad.

Controlled by multiple onboard computers, the locomotive communicates with the engineer with a screen display and keyboard for engine and braking functions. The desktop controller includes the IFC – the Integrated Function Controller with two color LCD screens on the engineer's side and one on the conductor's side. The brightness automatically adjusts to ambient light, with the displays getting brighter in tunnels. In addition to the fuel quantity displays on the IFC, the side-mounted 5,000 gallon tanks have TSM fuel level readouts, which use a radar technology.

The 7FDL16 prime mover in the AC4400 features a split cooling system. Computers monitors the coolant temperature and automatically throttle back the prime mover if the temperature approaches dangerous limits (230 degrees F). Before the water is admitted to the radiator, the temperature must exceed a low limit. Otherwise, the water is circulated through the engine block, oil-cooler and turbo-intercooler only. When the valves to the radiator are opened, the flow rate is 600 gallons per minute through the big wings on the rear of the unit. The fan direction can be reversed momentarily via switch, to clear debris from the radiator inlet screens. Electronic fuel injection for the prime mover is standard. It squirts the fuel into the cylinders at 18,000 psi. The EFI replaces the mechanical governor. The three-phase, 10-pole AC traction alternator is basically the same as on B40-8 units, operated at a higher voltage. An auxiliary alternator provides the excitation supply, powers auxiliary motors and charges the 64-volt batteries. The batteries are used to start the prime mover, providing power to an inverter, which is in turn applied to the main alternator. Main alternator loading can be tested by applying alternator output to the dynamic braking grids.

The traction motors and alternator are cooled by an electric motor driven fan. A separate AC motor powers the radiator fan. The locomotive can be moved a short distance with the prime mover off by supplying battery power to the number six traction motor, through the inverters. Traction motors are numbered from one at the front of the short hood end, to six at the end of the long hood. The locomotive's air compressor is driven by an AC motor. It's speed is independent of engine speed. Traction motors can be individually isolated.

A toilet is located in the nose of the unit, with a 100 gallon retention tank. The cab is equipped with electric heat and air conditioning for crew comfort. The cab includes a small refrigerator on the conductor's side of the cab. Lighted front number boards are used, but no rear number boards. An event recorder function is provided with a hardened removable memory unit which stores the last 48 hours of significant events.

Between 1994 and 1996, CSXT purchased units through road number 173. Units through number 300 were delivered by September 1997. Models numbered after 201 feature GE's bolsterless HiAD^{tm} steerable trucks, referred to as the *rollerblade*. Units 260 through 269 have the necessary equipment for EABS – the Electronic Air Brakes. These are active only with specially equipped cars, with the reporting marks APOX. The 230 volt line is used to activate all brakes at once. The use of this system is expected to see more widespread application as operational experience on railroads is gained.

Numbers 600-602 were pre-production models, with the 4400 HP prime mover.

Unit 130 was destroyed in a collision in Cayce, South Carolina, in February of 2018. The CSX engine was stationary, and was hit by a southbound Amtrak Silver Star, around 2:30 AM. On the Amtrak side, 2 crew were killed, and 116 passengers injured. On the CSX side, there were no injures or fatalities, although the cab was completely destroyed. The locomotive was scraped. The cause of the accident was determined to be that the Amtrak train was on the wrong track. The signals were not working, due to maintenance, and CSX was doing manual dispatch. CSX was deemed responsible, as the switch was lined off the mainline towards the siding, on which the CSX engine was parked.

The CW44AH model was acquired to handle CSX's heavy grades near Grafton, WV. These were ballasted to 250 tons, and have software updates for increased traction. Several units were converted from AC4400CW's. (I am thinking about how to explain to a steam hogger what “software updates to increase traction” means.)

Unit 496 was wrecked and retired. Units 517 and 771were wrecked; 471 was repaired

AC6000 (CW60-9 AC)

The first unit of this type on the road was commissioned into the CSXT fleet in ceremonies at the B&O Railroad Museum, Mt. Clare, Baltimore, MD on September 13, 1996 by CSX President Pete Carpenter. The units cost about two million dollars each, but can replace multiple units of previous classes of traction power. This locomotive features a Deutz 6,000 horsepower (at 1,050 rpm) prime mover and six GEB-13B AC traction motors. Using the HiAD^{tm} trucks (*rollerblade*), these units achieve an adhesion factor of 37 percent or better. The 7HDL16A prime mover was jointly developed by Deutz Motoren Werke Mannheim (MWM) of Germany and General Electric. The prime mover itself weighs 47,500 pounds and contains 582 gallons of oil. The locomotives are 74 feet long, carry 6,000 gallons of fuel and forty cubic feet of sand. The starting tractive effort is 180,000 pounds. They use one inverter per traction motor. Extensive use is made of onboard microprocessors for diagnostics and control. On the road, the diagnostics computers can communicate with computers at a maintenance base via satellite link, to alert shop personnel about needed repairs or replacements.

The unit showcased at the museum ceremonies was numbered 602 and lettered *Spirit of Maryland*, with flags painted on the cab sides. Previously, units 600 and 601 had been delivered and were at work in standard CSXT paint. Initially, units 600 and 601 were run only as a set. This practice ended by March 1997. The three pre-production 600-series locomotives are now in CSXT pool service, with favorable results. Unit 600 went back to GE around the end of 1997 to be fitted with the radial trucks and to get a software upgrade. It spent from March to May 1998 at the AAR test track in Pueblo, Colorado.

In the summer of 1998, unit 601, with the generation I steerable trucks, and unit 600 with the generation II trucks, were put through their paces on the hard grades and curves around Grafton, West Virginia, with heavy coal drags between Hardman and Terra Alta. Once again the B&O's crucible, the 17 Mile grade, became a benchmark of locomotive performance, as it has been since before the Civil War.

Unit 601 was lettered *Spirit of Waycross*. Units 600 and 601 were re-lettered to the same scheme used on 602. Late in December of 1998, units 603 and 604 joined the CSXT team in Cleveland, Ohio. The new units will have the steerable truck.

The GE AC units had some problems with their traction motor gear case casting, a problem that was corrected by the manufacturer. CSX C60AC's have been retired and were sold to Progress Rail.

CSX re-powered some of its CW60AC and CW60AH models with the new GE GEVO-16 prime mover in place of the 16-7HDL.

The CW46AH is a re-power of a AC6000CW, using the new GEVO-16 prime mover. These are rated at 4,600 horsepower, but can provide up to 5,800. They are, when operated within limits, environmentally friendly, and reliability has been enhanced. Units 603 through 699, and 5000-5016 were involved in this program. This conversion results in, essentially, a ES46AC model.

What's new at GE

The GE Evolution Series was introduced in 2005 as a follow-on to the Dash-9 series. The locomotives have twenty Intel Pentium class microprocessors in charge of many of the subsystems. There are onboard networks between the computers, and the various components they monitor or control. The networks use the Bosch CAN network model. They also use the legacy RS-232 asynchronous serial connections, RS-488, a bus architecture, Ethernet, and ArcNet (standard computer industry protocols and systems). The computers run the QNX real-time operating system, a variation of the Unix operating system (Windows is NOT real time). The applications code includes Matlab, and the language c++. All this is not to take the engineer out of the loop, but rather to assist him (or her) in the safe operation of the train. More sets of eyes, ears,etc.

GE's Powerhaul, 6-axle series was introduced in 2009, with the model P616 prime mover, with 3,690 horsepower. These are marketed internationally. Thirty went to the UK. A Turkish company has a manufacturing agreement with GE to produce locomotives for the European, Middle Eastern, and African markets. Some units are working in South Korea. An Australian locomotive manufacturer is developing a narrow gauge (3 foot, 6 inches) version for home use. At the moment, these locomotives are all for export.

Modern digital displays are used in the cab. Dynamic-braking generated power is first used to supply auxiliary equipment, with the excess being dissipated in radiators. The 4-cycle prime mover is high-reving, giving a better power-to-weight, as well as meeting European emissions standards. This involves exhaust gas recirculation, and a special diesel catalytic converter. The AC alternator feeds rectifiers that, in turn, feed each ac traction motor through a separate inverter. The GTA alternator and 5GEB30 traction motors are used. The European Rail Traffic Management system is being implemented in the locos. Expect a derivative model wandering U. S rails soon.

ES40DC

This 4,000 hp model replaced the Dash-9-40CW in the GE lineup. These only went to Norfolk Southern, but a series of CSX ES44DC were given this designation after derating to 4,000 hp. Unit 5488 was scrapped, probably due to wreck damage, and unit 5500 became the *Spirit of Cincinnati*.

ES44AH

These units replaced GE's Dash9-44CW. They are 4,400 horsepower built by GE until 2004. Due to stricter emissions (Tier 4) requirements, this unit replaces the AC4400CW. Unit 3099 was wrecked and retired.

CSX ordered a series of these with extra weight for enhanced traction. They tipped the scales at 432,000 pounds. The “H” refers to heavy. They also received steerable trucks, and got the HTE software update (which doesn't weigh anything) to enhance traction to 36,000. They have GE's *Rail Cleaner* which puts high pressure air in front of the sand nozzles on the number one (front) axle.

Unit 130 was wrecked in South Carolina

ES44AH (T4C)

This is CSX's designation of GE's ES44AC's. They got 200 of the units, starting in 2007. The “H” designation is for “heavy.” they weigh in at 432,000 pounds. The units have steerable trucks, and massive tractive effort at low speeds. They include GE's TM3 adhesion control software, which increases tractive effort by 10%. They also have a GE track cleaning system that uses pressurized air blown on the tracks in front of the sand nozzle sin front of axle 1. The GE Evolution Series ET44AC locomotive meets the U.S. Environmental Protection Agency’s (EPA) stringent Tier 4 emission standards.

What’s next from GE?

Having achieved the 6,000-horsepower threshold with the new Deutz engine, GE is looking to an 18-cylinder, 8,000-horsepower version. In addition, everything is going towards low emissions, and high fuel economy, as well as advanced monitoring and diagnostics. Remote diagnostics “phone Home” so the locomotive can be sent directly to the shop for needed repairs. All of this is following the automotive model, where more advanced sensors and onboard diagnostics is becoming the norm, GPS has been available for some time. The next hurdle is to get Positive Train Separation working on a system-wide and country-wide basis. This has no counterpart, yet, in the automotive world. What is evolving is car-infrastructure communication and coordination, as well as car-car coordination. A concept being worked on is convoying trucks, with only the lead unit having a human driver. Gee, sounds like a train.

Besides locomotives form EMD and GE, CSX has bought locomotives from NRE/Rail Power Industries. These are discussed below

NRE

Current National Railway Equipment's models are all AC power. NRE has an interesting approach to providing appropriate power, called N-ViroMotive. These locomotives are mostly for yard use and urban environments. This segment of the locomotive market has basically been abandoned by the big boys. Located in Illinois, NRE sells new and rebuilt units worldwide.

3GS21B

This 4-axle switcher has three Cummings QSK19C prime movers, each developing 700 H.P. Computer controlled, they are reducing emissions, and enhancing efficiency. The optimal number of prime movers can be operating or shut down as the load requires. The computer can select the engines on a rotating basis, providing load-leveling. CSX has 16 of these units, numbered 1300-1315

3GS21C

Following their key design, this locomotive also has three prime movers. CSX has one unit, number 1600.

2GS14B

CSX has three of these units, numbered 1316-1319. These have two of the Cummings prime movers.

R. J. Corman

The R. J. Corman Railroad Group is a private company in Kentucky, but with field locations in 23 state. Mr. Coreman founded the company in 1973, but passed away in 2013. The company currently owns eleven short line railroads. One of its focuses is building “Eco-friendly” locomotives in its subsidiary Railpower Technologies. This company was acquired by Corman in 2009. It has experimented with diesel-hybrid locomotives. CSX rosters several of its units.

RP20BD

This 4-axle unit has three diesel engines, but is built on a GP-9 or GP-38 platform. It uses the 2,000 hp Deutz 2015 V-8 engines, with a Cummins available on request. Deutz is now owned by Caterpillar. The CSX number is 1320.

RP20CD

This is a 6-axle unit, with three or four of the Deutz engines. The CSX units are numbered 1601-1603.

What’s next for CSXT?

As we enter the next century and millennia, CSXT will continue to try to optimize locomotive usage and reduce maintenance costs. Stricter regulations are looming on the near horizon for locomotives’ emission control, which can only effect fuel consumption negatively. Experiments with alternative fuels such as liquefied natural gas (LNG) and coal powder have yet to show hard pay-off numbers over the use of diesel fuel. CSXT experimentation with fuel tankers for road use did not deliver the expected results and were canceled.

There is a reluctance on the part of diesel prime movers manufacturers to certify their units for the use of bio-fuel. Bio-diesel is more environmentally friendly, being derived from bio-mass. It does have different lubricating properties. The Grand Canyon Railway uses it in their oil-fired steam locomotives. These are, of course, external combustion. Dubbed “fry-brids” when they employ used cooking oil, they certainly smell good, going by trackside.

Older locomotives will be retired and the fleet will be modernized and become more homogeneous, thus simplifying fleet maintenance. Older, four-axle units will be retired and replaced with newer, six-axle units. Recall that diesels replaced steam engines because they were cheaper to maintain and provided maximum starting tractive effort. The newer AC locomotives are cheaper to maintain and provide more starting tractive effort than the older DC units. The newer AC units such as the AC6000 from GE are designed to replace two older units. Single unit trains are becoming more common on CSXT tracks, as the AC6000 is rated for 150 coal cars on level track. Not up or down the 17-mile grade.

As of this writing, CSX's fleet is predominately from GE (almost 50%), with an additional 35% from EMD. The rest are from builder NRE or Progress, or rebuilds from other lines. The stable of locomotives is 40% AC traction, 60% DC.

Locomotives inherited from predecessor roads

This section discusses the various EMD and GE locomotives that CSXT inherited from its predecessor roads. The railroads that were directly merged into CSXT were the C&O and Seaboard System. Predecessor roads include the Atlantic Coast Line (ACL), The Seaboard Air Line (SAL), Clinchfield Railroad(CRR), Atlanta & West Point (A&WP), Georgia (GARR), Western Railroad of Alabama (WRA), the Durham & Southern (D&S), Seaboard Coast Line (SCL), the Louisville & Nashville (L&N), Family Lines (FAM), Chesapeake & Ohio (C&O), Baltimore & Ohio (B&O), the Western Maryland Railway (WM) and Chessie. If we include the many lines that merged into these over the course of years, the comprehensive list of predecessor roads runs into the hundreds. Through 1988, CSXT operated with a motley collection of inherited EMD and GE power. In an effort to reduce maintenance costs, most of the first-generation units were disposed in 1983.

As older units reached the end of their useful life, they were dropped from the roster. Along the way, some were promoted to yard power, or converted to slugs. A large number of the GP series became slugs, in CSX's program. This section discusses the older EMD and GE units. There are at least 33 EMD types and 17 GE types that were rostered by CSXT starting in 1983. In 1996, the CSXT roster included 13 different GE types and 24 EMD types.

Some older units stay around for yard service or parts donation, until they too head off to the scrapper.

Fewer different models on the roster is desirable, as fewer spare parts must be stocked and maintenance and operating crew training is simplified.

In 1997, CSXT and Norfolk Southern agreed to acquire the assets of Conrail. For the motive power fleet, this meant the infusion of some 1,000 used units. For CSXT, there were no surprises; most of the equipment, with the exception of the SD80MACs, was already operated.

EMD locomotives from predecessor roads.

This section discusses EMD units that CSXT inherited from predecessor roads. EMD's best sellers were the GP9 models, the SD40-2 and the F-units. CSXT got all of these and a lot of others besides. At least 32 different types of EMD diesel locomotives were on the CSXT roster at one time or another, before CSXT bought its first EMD unit directly, the SD60s.

F7A/F7B

The F7 series, introduced in 1949 as a successor to the F3s, was very successful for EMD. A total of 7,374 F units of all types were manufactured between 1939 and 1957. Many lines purchased and operated the units and it is not uncommon to see veteran F units working even today. The prime mover in the F- series was a 1,500-horsepower type 567 diesel engine in a V-16 configuration.

The F7A featured a 1,500-horsepower prime mover and four-wheel trucks, with a cab-style body. The FP7 model added head end power (HEP) for passenger service. This involved a boiler for steam heat and provision for supplying electrical power to the passenger cars. This locomotive was four feet longer than the freight model. CSXT F-unit 118 is equipped for passenger service, and has a Vapor OK-4625 steam generator unit.

An F7B, although it did not have a cab, was essentially identical to the A unit. Some B units did have hostler controls for low speed throttle and brakes, so they could be moved independently around the yard. The front end of a B unit was the end with the electrical control panel. As with the other types, a small letter F was painted on the lower body at the front end. A total of 1,483 B units and 2,366 A units were built. These units used the 57:20 gear ratio and achieved 27,500 pounds of tractive effort at 17 mph. CSX Unit 119 did not have dynamic brakes, but the others had the standard-range, tapered-type. The units were equipped with type-E couplers.

EMD predecessor roads operating F3 or F7 units included WM, B&O, C&O, Chessie and Clinchfield Railroad (CRR).

Most F7 units were retired by Chessie before CSXT was formed. CSXT kept and restored four ex-Clinchfield units for special executive service. "A" units had even road numbers and "B" units had odd numbers. Units 117 and 118 were renumbered 417 and 418 for CSXT to make room in the roster listing for the new GE Dash-9 units.

CSX	formally	type	weight
116	CRR 800	F7A	239,000
117	CRR 869	F7B	243,000
118	CRR 200	FP7A	242,000
119	CRR 250	FP7B	243,000

The two pairs of F-units could be found in 1988 in RoadRailer service, as CSXT gained operation experience with this type of rolling stock. Pulling these loads in Ohio and Tennessee, the F's were used in regular freight service for the first time in 15 years. The RoadRailer trials only lasted 8 months.

Units 117, 118 and 119 were leased to the Maryland Rail Commuter (MARC) system for a while, when the commuter service found itself power short. They also served on excursions, visiting Cumberland and Frostburg, Maryland, in the peak of the Fall foliage season. Unit 117 went to the West Virginia Central. Unit 119 blew its main generator in 1992 while in MARC service. Unit 116 is with the C&O Historical Society.

Units 117 and 119 were on the roster of the Moorefield, West Virginia, Potomac Eagle excursion train, on the South Branch Valley Railroad tracks, renumbered 417 and 418. They had gone to Huntington, West Virginia Shops in early 1999, for rebuild, evaluation, and a repaint to prepare them for executive train service.

Unit 116, originally built as a F3A, but rebuilt to an F7A in 1962, is also in Moorefield and is owned by the Chesapeake & Ohio Historical Society. CSXT 119 was retired in November 1992, due to electrical problems. It was donated to the B&O Museum, Mt. Clare, Baltimore, Maryland From there, it was traded to the Tennessee Valley Railroad Museum (Chattanooga, Tennessee) in exchange, so B&O E8A number 92 could come home.

EMD SW series

The EMD switcher SW1001 was used by CSX, and numbered 1128. This was a one thousand horse power unit, intended for switching. It used the powertrain of the SW1000, and the underframe and cab of the SW1200. It had a modified version of the 645 engine. These came from predecessor L&N.

CSXT rostered a series of the EMD SW1200 and SW1500 yard switcher models from predecessor L&N. They all used the 62:15 gear ratio, meaning the motor pinion had 15 teeth and the wheel side had 62. This is a gearing down of the motor - it reduces speed, increases torque. The SW’s did not have dynamic brakes. The prime mover for an SW locomotive was a 12-cylinder type 567C rated at 1200 or 1500-horsepower. They were built from 1954 through 1966. SW1200’s numbered in the range 9615-9621 had a weight of 248,000 pounds with a tractive effort of 35,000 pounds at 10 mph.

Five SW1200 models from the RF&P were rostered by CSXT in their original numbers 81-85. In the fall of 1992, numbers 81-83 were renumbered 1300-1303. Unit 1315 is ex-RF&P 91. The other units were off the roster by that time, some having been sold to the Aberdeen, Carolina & Western in North Carolina. In April 1993, CSXT 1300 was still in service. No SW1200s were on the CSXT roster by 1998.

Thirty units of the SW1500 type, numbered 1100-1129 came from L&N numbers 5000-5029. These models weighed 253,000 pounds and achieved a tractive effort of 43,000 pounds. They had 1,100 gallon fuel tanks and used a 62:15 gearing. EMD produced a total of 807 of these units, from 1966 to 1974. Twenty units remained on the CSXT roster in 1999. CSXT inhered 30 or more of these units from Conrail. They were renumbered lower in the scheme than the current SW1500s, starting with 1068.

CSX sent five of the SW1500's to LTEX. These were all built in the 1970's for predecessor Louisville & Nashville. At this writing, CSXT has 16 of these units.

MP15

EMD built a total of 539 MP15 models, of several different subtypes. The MP15 uses a main DC generator; the MP15AC model has an alternator. Both use a 12-cylinder, 1500-horsepower prime mover of the 645E design and all use DC traction motors. The MP15T uses a turbo-charged eight-cylinder engine of the same basic design, to achieve the same horsepower rating with fewer cylinders. All MP15Ts produced went to the Seaboard System (and then to CSXT), except for one that went to Dow Chemical. MP15s used the 62:15 gear ratio and did not have dynamic brakes.

CSXT had 65 of the MP15 units These include 55 of the MP15AC and 10 of the MP15. As of this writing, there are 47 of the MP15AC units on the roster, and 38 of the MP15T.

Model	road number	predecessor	weight
MP15AC	1130-1139	L&N 4225-4234	258,000
MP15(DC)	1140-1149	L&N 5030-5039	258,000
MP15AC	1150-1169	SCL 4000-4019	255,000
MP15AC	1170-1194	SCL 4200-4224	255,000
MP15T	1200-1241	SBD 1200-1241	253,000

MP15's numbered 1141 and 1143 and MP15T 1219 went to LTEX. Five of the MP15AC's went to Progress Rail. MP15T number 1214 went to the St. Mary's Railroad in Georgia. Unit 1220 was retired.

GP15/15T/15-1

There were a total of 368 units of the GP-15 family built from 1976-83. The GP-15 used the 1,500-horsepower 12-cylinder 645E prime mover and the -T model used the turbocharged eight-cylinder. The GP-15 used the D32B generator, rated at 2,350 amps and the D77B traction motors. The GP15T model was only used by the C&O. They were built in late 1982. The units were acquired by Chessie and originally were seen exclusively in the Chicago area. CSXT rostered 25 units, numbered in the series 1500-1524, the same as the C&O numbers. The units had standard dynamic brakes. CSXT absorbed some 40 Conrail GP15-1 units, renumbering them starting at 1525.

The GP15 is still offered by EMD in 1998. It now features an alternator, and uses re-manufactured Blomberg trucks. The new GP15 uses a 4-cycle V-12 prime mover.

The most common gear ratio on this model was 62:15, giving a 65 mph maximum speed. The gear ratio refers to the number of teeth on the traction motor pinion and on the wheel ring, to which it engages. The engines weigh 244,000 pounds and hold 2,400 gallons of fuel. Capacities are 46 cubic feet of sand, 165 gallons of lube oil and 230 gallons of cooling water. The GP15s achieve 47,000 pounds of tractive effort at 9.3 mph.

While working on the C&O, the GP15T (turbo) units were found to be more efficient than the standard GP15’s. The GP15T, at idle, used one-half the fuel of a standard GP15. Engaging in heavy haul, the GP15T could save the railroad twenty percent on fuel costs. A GP15T can be identified by its single exhaust stack. Seven of the

GP15 and GP15T, by November of 2018, went to dealers, including LTEX, and Locomotive Specialists, and number 1524 went to the Adams Warnock Railroad of Georgia.

The -1 models has the 12 cylinder 645E prime mover of 1,500 horsepower. These came to CSX via Conrail.

Recently five of the GP-15T's were retired. These were ex-C&O units. Three went to LTEX, and two to Adams Warnock railway in Georgia. Of the GP-15-1's, three went to LTEX, with one going to Valley Railroad. As of this writing, there are 20 of the GP15T models on the roster, and 22 of the GP15-1

GP30

GP-30 models, second generation roadswitchers from EMD, are said to show the influence of GM's automotive design heritage. A total of 945 units were produced from 1961-65. All use the 567D prime mover rated at 2,250-horsepower in a turbocharged V16 configuration. The prime mover drove a D22DT generator, which fed the D57 traction motors, rated at 980 amps each. Predecessor roads using these units include B&O, C&O and SBD. All used the 62:15 gear ratio, except for unit 4045, which had a 61:16 ratio. A number of GP30 units were converted to road slugs by CSXT and the rest were sold to shortlines, or were scrapped. Some ex-SBD units went to Burlington Northern, converted to GP39M models.

GP-30M units were GP-30s, de-rated to 2,000-horsepower at the CSXT shops in Cumberland or Huntington with a new prime mover. This was done in conjunction with a *Class-1* overhaul. In addition, there were changes to the wheel-slip control (IDAC was added) and they received the same transition control as a GP-38. They also got electrical cab heaters. A total of 65 units got this treatment from 1981-1983. Four GP-30Ms remained on the CSXT roster in December 1996. The last GP-30M in CSXT service, unit 4216, was retired September 9, 1997. It had been C&O unit 3021, built in 1962 and rebuilt as a GP-30M in 1983. A single CSXT GP30M went to Maintenance of Way (MoW) service as *Pumpkin* 9600. Unit 4239, ex-B&O 6918, moved far from home to become Puget Sound & Pacific 3005 in Puget Sound, Washington.

A series of 34 of the C&O's 48 unit fleet of GP-30s were given the GP-30m treatment at Huntington Shops. Most of the B&O units were done at Cumberland, except for B&O 6952 (CSXT) and B&O 6976 (CSXT 4266) at Huntington

A number of GP-30s were converted to GP-30M's at Cumberland. These were all ex-B&O units.

CSXT models numbered 4000-4140 were “stock” GP-30, where models numbered in the range 4200-4266 were GP-30m. The GP-30 is visually distinguished from predecessor models by a raised roof section from the cab to the radiators in the roof. CSXT predecessors favored the low nose model. ACL got units without dynamic brakes, where most of the rest opted for them. These units were typically operated short hood end forward. C&O GP-30s (old numbers 3000-3047) had switchable control for the dynamic brakes. These could be operated in either the older field loop control mode, or the newer potential mode, select-able by a switch in the electrical cabinet. The C&O had traded in 14 BL2 models for their GP-30 units 3002-3015. GP-30 models tended to have standard tapered dynamic brakes, while -M models had flat style brakes. The direction of sanding was controlled by a valve on the engineer’s control stand. It was automatic in later locomotive models. The C&O units were equipped with cab air conditioning. They also came with the Leslie S-5T horns. However, due to the height of the units, the horns could not be mounted on the cab roofs. They were mounted on the sides of the cab, below the roof line, two on one side and three on the other.

Unit 4039 did not have dynamic brakes, nor did units 4055-4093. The maximum continuous tractive effort was 50,000 pounds at 12 mph; for unit 4045, it was 46,200 pounds at 13 mph.

The typical GP-30 or GP-30M weighed 262,000 pounds and carried 2,600 gallons of fuel. It had 46 cubic feet of sand, 200 gallons of lubricating oil and 240 gallons of cooling water. Some of the early GP-30 units in the number range 4039-4086 weighed 248,000 pounds. The GP-30 (and –M models) were gone from CSXT rails by 1998. Unit 9600, a maintenance of way *Pumpkin* unit, was gone by the end of 1997.

GP-30 models, origins

4000-4140	B&O 6900 series; C&O 3000 series

GP-30M models, origins

4200-4233	C&O 3000-3046
4234-4266	B&O 6904-6974

GP-38/GP-38-2

The GP38 model was manufactured by EMD from 1966-75. A total of 2,921 units were produced. The prime mover was the 2,000-horsepower 645E engine with 16-cylinders. The GP38 uses the D32B generator and D77 traction motors, rated at 1,050 amps apiece. The GP38-2 model has an alternator in place of the main generator and is sometimes listed as a GP38AC. The alternator is physically smaller than the equivalent capacity generator. The traction motors remain DC. The units were numbered by CSXT as 2001-2189 (GP38) and 2500-2716 (GP38-2). Predecessor roads using these models included SBD, L&N, SCL, C&O, RF&P and B&O. L&N rostered some of the AC models. The CSXT GP38/-2 models all have the 62:15 gear ratio, except for units 2500-2555, which have 61:16.

The typical GP38 weighs 277,000 pounds and carries 3,600 gallons of fuel, in addition to 75 cubic feet of sand, 243 gallons of lube oil and 240 gallons of cooling water. GP38 models have individual traction motor cut-out switches and a constant-horsepower prime mover control system. This assures a constant 2,000-horsepower production at all engine speeds. Tractive effort ranges from 51,600-55,460 pounds.

The C&O units were equipped with paper air filter elements by 1977. This necessitated relocation of the bell. The C&O units also had the Leslie SL-3L-R horn sets. The earlier C&O units (3850-3898) had footboards, where the later units had rock pilots. The later units also had the incinerating toilet.

CSXT had 56 GP38 and 186 GP38-2S models on its roster, including some serving as Maintenance of Way units. The GP-38S models are non-turbo. Unit 2002 (ex-B&O 3802, builder number 33320 10/67) was chosen by *Trains* magazine as their “All-American Diesel.” Unit 2002 was supposed to go to the B&O

Museum at the end of its service. However, it turned up in MoW Pumpkin Orange, as unit 9699. Unit 2048 was the Operation Redblock unit for the Mobile Division. Unit 2107 retained a B&O blue paint scheme with a yellow CSXT nose and other units retained Chessie, Family Lines, or Seaboard paint. Unit 2162 became HATX 175; and unit 2168 became HATX 176. CSXT had 186 of the GP38-2 units in 1997, including Unit 2704 is in Operation Redblock paint. CSXT got more than 50 more GP38s from Conrail, and some 100 more GP38-2s. The pre-merger, Spring 1999 CSXT roster showed 27 GP38 units in mainline service, and 17 more as pumpkins. The GP38s will be renumbered below the current series of GP38s, starting around road number 1943. The GP38-2s were renumbered starting at 2717.

Unit 2107, the sole unit on the roster in the original B&O blue paint scheme, went to rebuilder/recycler VMV in 1999. Units 2574 and 2661 went to Progress Rail along with GP38-2S unit 6150. As of this writing, CSX retains 215 GP38-2's, and 34 of the GP38-2S.

Some units were upgraded to GP38M-2. GP38-2's have been tested by the South West Research Institute for the U.S. Government with use with bio-diesel.

GP39/GP39-2

A GP39 is a GP38 with a turbocharged, 12-cylinder, 2,300-horsepower 645E3 engine in place of the 16-cylinder engine. The other locomotive specifications are comparable to GP38 models. The visual difference between a GP38 and a GP38 is that the GP38 has two stacks on either side of the fan, where the GP39 has a single stack ahead of the dynamic brake fan. The GP39 unit weighs 277,000 pounds and carries 3,600 gallons of fuel in addition to 72 cubic feet of sand. The -2 units have a AR10-A4 alternator in place of the generator. Both use D77B traction motors. A total of 392 of all types was built by EMD from 1969-1970. They achieved a tractive effort of 55,000 pounds at 11.3 mph.

The GP39s were used exclusively by the C&O as that line got 20 of the 23 built. These units had standard-range, taper-type dynamic brakes and were equipped with the standard 27-pin MU connector. Fifteen of the 20 were modified by the C&O to serve as mother units for C&O's yard slugs. More than one slug could be used with a single mother.

Seven GP39-2 units came to CSXT from the Reading, via the D&H, in 1991. These were transferred in lieu of a loan payment. CSXT 4316 was the last GP39-2 in CSXT service in the Reading green paint scheme. It was subsequently repainted. Unit 4301 was in Guilford gray in 1997. GP39 models were numbered 4280-4299 and GP39-2 units were numbered in the range 4300-4319. CSX still has the GP-39 units.

GP40

EMD built a total of 1,243 GP-40 units. They featured a 3,000-horsepower, 16-cylinder turbocharged 645E prime mover driving an AR10-A alternator rated at 4,200 amps, which produced 600 volt, 75 Hertz alternating current at 900 rpm. This is rectified to direct current before being applied to the D77 traction motors, rated at 1,050 amps each. The use of the alternator in place of the generator had several major advantages, according to a 1965 EMD press release. The alternator was more efficient than the generator and produced about twice the output per unit weight or volume. Equivalent generators would have necessitated longer and wider/higher locomotive bodies and more cooling. The use of the alternator was enabled by the development of solid state rectifiers that could handle the large current. EMD had worked with rectifier vendors and field tested the units for more than two years before they were fielded in operational locomotives offered to customers. The alternator/rectifier system requires less maintenance than the generator it replaced. It eliminates the generator brushes, a major maintenance item, and eliminates the complexities of transition control. The next major breakthrough would come years later, in the use of AC traction motors.

In the alternator systems, the diodes were protected by individual fuses. At the same time, improved insulation was used in the alternators, with silicone rubber replacing fragile glass and mica. The AR10 alternator was the result of a ten year development program at EMD.

Predecessor roads using the GP-40 include WM, B&O, C&O, RF&P, Seaboard (SCL), A&WP, GARR, WRA, L&N and RF&P. CSXT GP40 units were numbered in the range of 6500-6867. One GP40 was rebuilt into a CSXT road slug, and many of the GP40 units went to MoW service. Units 6796, 6818, 6718 and 6726 were painted for Operation Redblock. This was a union-initiated and management supported program for peer involvement in monitoring alcohol or drug use on duty. This successful program has been going on for more than 25 years.

Unit 6845 (ex-C&O 4090) was rebuilt at the Huntington Shops using GP40-2 parts from wrecked units, after it suffered fire damage in Kentucky in 1979. It was renumbered 6000 and was still considered a GP40. Units 121-127 from the RF&P also joined the CSXT roster. Units 6855, (ex- RF&P 121) and 6857 (ex- RF&P

123) were still working in 1997. Many GP40s went to Motive Power Industries in Boise, Idaho, in 1997 to be rebuilt into GP38m units, with a de-turbocharged prime mover and modern microprocessor control. CSXT does not intend to acquire any of these units.

B&O unit 3684, which became CSXT 6500, was donated to the B&O Museum at Mt. Clare and restored to B&O paint. Unit 4070, ex-C&O 6645, was the first C&O unit to be painted and lettered CSX. Another unit, CSXT 6569, ex-C&O 3794, has the distinction of being the last GP40 built by EMD.

Dynamic brakes were optional on the GP-40 and the B&O and C&O units had the extended-range dynamic brakes. The RF&P units were not equipped with dynamic brakes. Most units weighed 277,000 pounds and have comparable specifications to GP38 and GP39 models. They carried 3,600 gallon fuel tanks and 72 cubic feet of sand. The ex-Western Maryland units had 3,200 gallon fuel tanks and carried 56 cubic feet of sand. Almost all of the CSXT GP40s had the 62:15 gearing. They have the standard 27 pin MU connector. The C&O units had Leslie SL-3L-R horns and rock pilots front and rear. They came with incinerating toilets, later replaced by retention type.

CSXT	origin
6500-6554	B&O 3684-3779
6555-6569	C&O 3780-3794
6570-6574	WM 3795-3799
6575-6639	B&O 4000-4064
6640-6645	C&O 4065-4070

Units 6500-6645 were Chessie numbers 3684-4070. They weighed 277,000 pounds and had extended-range, tapered dynamic brakes. They generated 55,000 pounds of tractive effort at 11.3 mph.

6647-6652	A&WP 727-732

6654-6655	GARR 752-753
6657	SCL 1500
6659-6788	SCL

Units 6646-6671 came from SBD predecessors and retained the old SCL/SBD numbers. They weighed 261,000 pounds and generated 54,700 pounds of tractive effort. They had standard, tapered dynamic brakes. Unit 6776 had a Georgia Railroad hood, and the cab and nose of an SCL unit. It was also stenciled GP40-*2*.

6700-6720 These units had the 61:16 gearing and were rated 50,400 pounds of tractive effort at 12.2 mph. They weighed 263,000 pounds and had standard, tapered dynamic brakes.

6790-6796	WRA 701-705
6798-6825	L&N 3001-3029
6826-6854	C&O 4071-4099
6855-6861	RF&P 121-127

Disposition

The leasing firm HATX’s GP40 units 400-410 are ex-CSXT 6532, 6562, 6564, 6577, 6650, 6659, 6664, 6681, 6759, 6501 and 6592. Other GP40 units went to HATX as well.

MARC, Maryland’s commuter railroad, GP40WH-2 numbers 51, 52, 53, 55, 62, were re-manufactured by Morrison-Knudsen from CSXT units 6590, 6518, 6786, 6536, 6679 and 6637. The MARC units have the EMD 645E 3,000-horsepower engine, HEP, the F45-type wide cab and SD45-type flared radiators.

Other GP-40 units were rebuilt for passenger service on the Virginia Railway Express (VRE) by Morrison-Knudsen. The ten VRE models RP39-2C are rated at 2300-horsepower, using a 12-645E3 prime mover, 57:20 gear ratio and with 268,000 pounds weight. They include a Cummins HEP unit. The numbers V20-V23 are GP40PH units.

Number	Previous
V01	CSXT 6669, ex-SS/FL 6669, ex-SCL 1512, ex ACL 927
V02	CSXT 6712, ex-SS/FL 6712, ex-SCL 1557, ex SAL 642
V03	CSXT 6569, ex-C&O 3794
V04	CSXT 6559, ex-C&O 3784
V05	CSXT 6789, ex-SS/FL 6789, ex-SCL 1635
V06	CSXT 6617, ex-B&O 4042
V07	CSXT 6821, ex-SS/FL 6821, ex-L&N 3025
V08	CSXT 6841, ex-C&O 4086
V09	CSXT 6814, ex-SS/FL 6814, ex-L&N 3018
V10	CSXT 6591, ex-B&O 4016 (2nd numbering)

Some of the second series of VRE engines (V11-V20) also came from CSXT units.

Some GP40 units were rebuilt to GP40-2 specifications. Unit 6502, previously B&O 3686, became a GP40-2 at the Morrison-Knudsen facility in Pennsylvania and became UP 5419. Quite a few others followed in this path. At least 32 GP40 units have donned the orange paint of maintenance-of-way service (Pumpkins).

GP-40-2

GP40-2's were produced in 1972-1986. They use the 3,000 hp EMD645E3 prime mover. They proved reliable, and some are still in use. They were good at high speed service. Predecessor company's include C&O , B&O, L&N, Conrail, Georgia Rail, RF& P, SCL, WM, and WRA all had GP40-2's. A lot of the GP40-2's became mother units for road slugs. Units 6427 and 6443 recently went to LTEX. These were both ex-B&O units.

The GP40-2 was an upgrade to the GP40, produced after 1972. A total of 1,236 were built. EMD "-2" units were equipped with the

AAR standard control stand. As usual with EMD units, the short hood end was considered the front. The GP40-2 units could supply 700 amps of dynamic braking and were equipped with the 26L air brake equipment. These units also came with GM's Instantaneous Detection and Control (IDAC) wheelslip system. This system monitored and controlled wheelslip during both power application and dynamic braking. Auto-sanding control was also provided based on detected wheelslip during power and dynamic braking modes. The GP40-2 uses the 3,000-horsepower 645E3 diesel prime mover, the AR10-A alternator and the D77B traction motors, rated at 1,050 amps maximum.

The EMD 645 family of prime movers is also found in marine and stationary applications. It evolved from the earlier 567 series, with a cylinder bore increase, and was introduced in 1965. These engines, including the follow-on 710, had identical external dimensions. The 645 engines could be produced with 8, 12, 16, or 20 cylinders. The 12- and 16- cylinder models used a two-piece crankshaft. The weight varies from 11 tons to 21.5 tons. The were mechanical fuel-injected until 1995, when they became electronically controlled. This helped increase efficiency, and reduce emissions. They are turbocharged.

Predecessor roads using the GP40-2 include WM, Seaboard, B&O, C&O and RF&P. A total of 35 ex-WM units went to CSXT. Road numbers for the GP40-2 models are in the range 6000 to 6499, and 6900-6947. Unit 6483 is in Operation Redblock unit. The EMD 50th anniversary model, B&O 4164, was painted gold and lettered *GM50* in 1972. It went to the Smithsonian. Unit 6392 was ex-B&O 4163 and had been numbered 1977 to commemorate the 150th anniversary of the B&O, that year. It was displayed at the B&O Museum at Mt. Clare. CSXT 6001 also once displayed the B&O number 1977 for the B&O 150th anniversary. This unit was originally B&O 4100. Unit 6129, ex-B&O 4230, was the last to be renumbered into the CSXT numbering system in June 1988.

The GP40-2 models weighed 277,000 pounds and carried a 3,600 gallon fuel tank. The sand capacity was 72 cubic feet and the units carried 243 gallons of lubricating oil and 254 gallons of water for cooling. Over the life of its long production run, numerous changes were made to the GP40-2 models. Most of the improvements were eventually retrofitted to older models. GP40-2 units were equipped with flange lubricators. These systems are designed to deliver 1/60th of an ounce of lubricant every 200 feet to the wheels of number three-axle (in forward motion) or number four-axle (in reverse). This system works only if the locomotive is moving and sanding is not in use. The flange lubricators reduce flange resistance with the rail in normal operations, as evidenced by the reduction of the characteristic annoying squeal of the flanges on curves.

Various GP40-2 units were modified to serve as slug-mothers by VMV Enterprises of Kentucky. The slug-mother provides current to the traction motors of the associated slugs, which have had their prime movers removed. Units that received this treatment include 6186 thru 6200, with the exception of 6197, which was wrecked and sold to Conrail for parts. Unit 6250 and units 6320 through 6344, also had the additional wiring added for motherhood. These units were all ex-B&O. C&O units in the number ranges 6400-6424 and 6484-6493 got the treatment at Huntington, or VMV.

Unit 6341 retained its Chessie paint and had been named *Arch McElvany* to honor a retiring B&O General Manager of Operations. This unit was originally B&O 4447 (2nd renumbering).

The RF&P units (140-147) did not have dynamic brakes. They had their cab signal equipment removed and reinstalled in ex-Chessie (B&O) GP40-2 units 6235-6245. The RF&P units were then relegated to yard service, as 6393-6399. CSXT units 6000-6399 were renumbered to 6400-6499. Unit 6146 was destroyed in an accident in West Virginia in August 1996. It was valued at $825,000 at the time. Unit 6077 was wrecked in a Burlington

Northern - Southern Pacific collision. Unit 6047 went to leasing firm GATX. CSXT got an infusion of 50 of Conrail's GP40-2 models, and they will be renumbered starting with 4400.

road number	was
6001-6063	B&O 4100-4164
6064-6083	C&O 4165-4184
6084-6155	B&O 4185-4256
6156-6160	WM 4257-4261
6186-6199	B&O 4287-4300
6200-6210	B&O 4301-4311
6211-6220	WM 4312-4321
6221-6250	B&O 4322-4351
6251-6269	WM 4352-4371 (renumbered 6924-6942)
6270-6319	C&O 4372-4421
6320-6344	B&O 4422-4446
6346-6365	SBD 1636-1656
6388-6391	SBD 6642-6645
6392	B&O 4163 (2nd renumbering)
6393-6399	RF&P 141-147
(units 6400-6483 are all ex-Chessie)	
6413	B&O 4299
6425-6460	B&O range 4287-4446
6461	B&O 4301
6493	B&O 4351

GP40-3

A GP40-3 is a rebuild from a SD40-2, at CSX's Huntington Shops. Twenty-eight units were given this treatment, to get an additional 30 years of service life. They got a new cab, with better crash protection (in some cases, a wide cab). They got upgraded cabin heating and cooling, a new engine control system, and Positive Train Control. The rebuild program was suspended in 2016, with the Huntington Shops still rebuilding 4-axle units.

GP60

The GP60 was the first of EMD's third generation. They were built between 1985-94. The unit was microprocessor-controlled, replacing a lot of relays and wiring. They had the 710G3A prime mover, in a 16 cylinder configuration. The three CSX units came from Locomotive Leasing Partners, part of GATX.

Six-axle Power

This section discusses CSXT's six-axle (C-C) EMD fleet. By putting more wheels on the rail, six-axle units achieve a higher traction with the same-axle loading. The downside is the maintenance of two additional traction motors and larger, heavier trucks. Access to the middle traction motor can also be a problem. The SD series stands for "Special Duty." Dash-2 models have the AAR control stand.

The key feature of a locomotive is not horsepower, but tractive effort. This depends on how much of the locomotive's weight can contribute to pulling power. Generally, locomotive weight is not the limiting factor, but weight-on-axles is. The maximum allowed weight for a four-axle unit, 280,000 pounds, translates to 70,000 pounds per axle. If we use the same 70,000 pounds per axle on a six-axle locomotive, we get a unit weight of 420,000 pounds. Using the same factor of adhesion, the six-axle unit can pull one and one-half times as much.

SD20-2

The SD20-2 is not an EMD manufactured unit. These were rebuilt from B&O SD35s at the Cumberland Shops between July 1979 and 1980. A total of five units were completed for the B&O. They used the 645E engine, producing 2,000 (down from 2,500) horsepower from 16-cylinders. The turbocharger was removed, as was the center radiator fan. The units retained two exhaust stacks. The source units were numbers 7401, 7403, 7404, 7405 and 7406, and were renumbered 2400-2404. The completed units were used in hump service in Cincinnati. Unit 2402 had been damaged there in a roundhouse fire, but was repaired in Cumberland and returned to service. Three SD20-2s were still rostered by CSXT in 1998.

The SD20-2 units weighed 386,500 (down from an SD35's 390,000) pounds and carried 3,000 gallons of fuel and 40 cubic feet of sand. The minimum continuous speed was reduced from the SD35's 9.4 mph to 7.3 mph. The tractive effort at minimum continuous speed gained 5,000 pounds. These units are considered light six-axle power, and did not have dynamic brakes.

SD35

CSX had 343 of these units built by EMD in the years 1964-65. The prime mover is a 2,500-horsepower type 567D3 turbocharged V16. The SD35d model has a de-rated prime mover of 1,500-horsepower. A D32 generator is used, with the D67 traction motors, rated at 1,000 amps each. CSXT predecessor roads using the SD35 model include the WM, SBD, B&O, C&O, SCL and L&N. The units held 3,000 gallons of fuel, 40 cubic feet of traction sand, 243 gallons of lube oil and 275 gallons of cooling water. The maximum continuous tractive effort was 77,200 pounds at 9.4 mph, except for numbers 4540-4548, which were rated at 53,250 pounds at 13.6 mph. Some SDP (Special Duty, Passenger) models were rostered; these passenger engines had an extended long hood for a steam generator. SD35 units have three fans on the top of the long hood, where the two outer ones are 48 inches in diameter and the middle one is 36 inches. SD40 models have all three fans the same size (48 inches). The SD35 models have the 27-pin MU connector.

CSXT road numbers 4505 through 4548 had extended-range dynamic brakes, where the other units had standard dynamic brakes.

Previous Chessie SD35 numbers include B&O 7400-7402, 7407-7419; C&O 7420-21, 7423-28, 7428, 7430-31; WM 7432-7436

number	previous	weight, pounds
4505-4539	L&N 4050-4539	392,000
4540-4548	4540-4548	354,000
4549-4572	Chessie 7400-7431	385,600 (B&O 7400-7419)
4573-4577	WM 7432-7436	390,000 (7420-7431)
4579, 4580	7801,7802	390,000
	Seaboard:	
4584	4584	366,000
4585-4588	4585-4588	368,000
4589-4593	4589-4593	371,000
4594-4599	4594-4599	354,000

SD35d numbers 1004 and 1008 came from SCL numbers 4 and 8. SD35 numbers 2420 and 2421 were ex-SBD 4509, 4510 (L&N 1217-1218). Ex-WM units 4574 (7433), 4575 (7434) and 4576 (7435) were retired in 1992. Unit 4550, ex-B&O 7402, was donated to the B&O Museum at Mt. Clare. Five other B&O units had been converted to SD20-2s; the rest were scrapped or went to shortlines. There were 33 units rostered at the end of 1991, but only one (No. 4559) remained by the end of 1996 and it was gone by 1997. Unit 4519 was at Midwest Metalics (ex-Pielet Brothers) near Chicago in the Spring of 1998.

C&O units 7422, 7427 and 7429 were equipped for remote operation and became TORCO 7800, 7801 and 7802, in Chessie paint. TORCO is the Toledo Ore Docks Company, owned now by CSXT. Most of these units have been scrapped, but 7801 passed through Cumberland, Maryland, in June 1996. TORCO 998 is ex-CSXT 4603, and TORCO 999 is ex-CSXT 4608.

SD38-2

The SD38-2 model was used by the SBD. It featured a 2,000-horsepower, 16-cylinder, type 645E prime mover and was essentially a six-axle GP38 model. The prime mover drove a AR10-E1 alternator and six of the D77B traction motors with 62:15 gearing were used. The SD38-2 weighed 380,000 pounds and held 4,000 gallons of fuel, 56 cubic feet of sand, 243 gallons of lube oil and 275 gallons of cooling water. These were ex-SBD/L&N numbers 4500-4504. The SD38-2 units achieved a maximum continuous tractive effort of 80,000 pounds at six mph. They did not have dynamic brakes. Some additional SD38's (not –2) models came to CSXT with the Conrail acquisition. Others came from the L&N. They were renumbered starting with 2455.

SD40

A total of 1,257 SD40s were produced by EMD from 1966 through 1988. They were purchased by CSXT predecessors WM, C&O, SBD, B&O, L&N and CRR. The C&O and B&O units feature extended-range dynamic brakes. SD40s feature a 3,000-horsepower 16-cylinder type 645E turbocharged prime mover driving an AR-10A alternator, with D77 traction motors. The SD40 achieved 82,100 pounds of tractive effort at 11.1 mph. They weighed 390,000-420,000 pounds and carry 4,000 gallons of fuel and 56 or 72 cubic feet of sand. They have 243 gallons of lubricating oil and 254 gallons of cooling water on the unit. CSXT road numbers were in the range 4600-4621. Eighty-three Chessie units were rostered in 1982, in the road number series 7500-7599. They were originally numbered in the range 8300-8438. Units 8433 through 8436 came from B&O units 7591 through 7594. Most but not all of the ex-C&O SD40 units were rebuilt at the Huntington Shops to SD40-2 models.

4600-4601	SBD 8300, 8309
4606	SBD 8326
4613-4617	C&O 7513, 7516, 7530, 7532, 7534

4618	WM 7445/Chessie 7545/CSXT 8396
4619	C&O
4620	ex-CSXT 8433, ex-B&O 7591
4621	WM 7496/Chessie 7596/CSXT 8438

All WM SD40 units in the 74xx series were renumbered into the 75xx series by Chessie. Unit 7445 became 7545, then CSXT 8396, then CSXT 4618. Unit 7446 became CSXT 8397, then NREX 8397. It became part of the Morrison-Knudsen lease fleet in 1994 as MKCX-9419. CSXT units 8398, 8399 and 8422 (ex-7447, 7448 and 7471) were part of a trade-in of 50 units to Morrison-Knudsen, for rebuild to SD40-2 specifications. 7447 was in service as Utah Railway 9011 and 7448 served as Southern Pacific 8627. 7471 was part of the Morrison-Knudsen (Motive Power Industries) fleet as road number 9044. Unit 7496, renumbered 7596 by Chessie and 8438 by CSXT, was renumbered to 4621 in May 1991 and assigned to yard duties. Unit 4618 remained in the Chessie Paint scheme, with the WM logo under the window. Unit 4617 in faded blue C&O paint still worked the hump in the Cumberland yards, the last unit in C&O paint. In 1997, it sported a new blue & yellow cab, nose and rear, but retained a blue long hood with C&O lettering. It was retired in March 1998, but not for long. It was seen in hump and road service in the spring 1998, along with other SD40 units, also supposedly retired. Unit 8433, renumbered 4260, ex-B&O 7591, became HATX 600. TORCO numbers 998 and 999 are SD40s.

SD40-2

The SD40-2 model was introduced in January 1972. They may be the most popular second generation six-axle unit in use. A total of 4,163 units were produced. They feature the Dash-2 modular electronics, a 3,000-horsepower 645E3 prime mover, AR10A-7 alternator and D77B traction motors are used in new design trucks. The EMD model SD40e is classified as a SD40-2 by CSXT. CSXT's SD40-2s were rebuilt in 1989-1991. CSXT predecessor roads using these models include Seaboard, Chessie, Clinchfield, B&O and WM.

Units 2411-2424 are renumberings of units in the range 8164-8190. Unit 8202 retains Seaboard paint. Number 8304 was destroyed in an accident in August of 1996 in West Virginia. It was valued at $723,000. at the time. Unit 8339 was sold to rebuilder Morrison-Knudsen. Units 2411 and 2412 were used at the Louisville Hump yard.

The 8240 unit, a typical ex-C&O SD40-2, puts 394,000 pounds on the rails and carries 4,000 gallons of fuel and 56 cubic feet of sand. It develops 83,100 pounds of continuous tractive effort at 11.1 mph. It has extended-range dynamic brakes, with taper control. C&O SD40 units were rebuilt at the Huntington shops in 1990 to SD40-2 units.

SD40-2 weights varied from 378,000 to 415,000 pounds B&O units had standard-range dynamic brakes, where L&N, SCL and SBD units had extended-range dynamic brakes. CSXT equipped the SD40-2 models with flange oilers.

8000-8039	L&N 8000-8039	
8040-8066	SCL 8040-8066	
8067-8086	L&N 8067-8086	
8087-8115	SCL 8087-8115	
8116-8126	L&N 8116-8126	
8127-8241	SBD 8127-8241	
8242-8261	B&O 7600-7619	
8262-8263	CRR 8971, 8973	(were SD45-2)
8360-8395	C&O 7501-7536	
8396-8400	WM 7545, 7547-7549	
8401-8420	C&O 7550-7569	
8421-8425	WM 7570, 7572-7574	
8426-8432	C&O 7575 – 7581	
8433-8436	rebuilt from B&O SD40's 7591-7594	

8437-8438	WM 7595, 7596
8439-8488	rebuilt from SD40s by Morrison-Knudsen (now Motive Power Industries)

B&O unit 7603 was wrecked at Germantown, Maryland, in a head-on collision in February 1981. It had been assigned the CSXT number 8245, but never saw further service. It was stored at Cumberland for five years and then scrapped.

Unit 8449 spent a lot of time at the Baltimore Street crossing in Cumberland. It was one of two units equipped with the HelperLink for Sandpatch grade service. This allows cutting off the helpers while moving, saving time and complications. The HelperLink system can easily be installed on different units by shops crew.

Unit 8579, originally B&O, went to LTEX at the end of 2018.

CSXT acquired a series of Conrail SD40-2 units, renumbered starting with 8800.

CSXT SD40-2 renumbering.

2411, ex-8168
2412, ex-8191
2413, ex-8182
2414, ex-8197
2415, ex-8164
2416, ex-8166
2417, ex-8180
2418, ex-8169
2419, ex-8170
2422, ex-8262
2423, ex-8263
2424, ex-8190
2425, ex-8171
2426, ex-8178
2427, ex-8172
2428, ex-8177
2429, ex-8167
2430, ex-8163
2431, ex-8174
2432, ex-8179
2433, ex-8187
2434, ex-8183
2435, ex-8193
2436, ex-8192

SD40-2 units also served as mothers for yard slugs.

SD40M-2

This model is a remanufacture from Boise Locomotive, a division of Motive Power Industries, for CSXT. Unit 8451 is typical of these. It uses the 645E3 prime mover, rated at 3000-horsepower. The main generator (traction alternator) is the AR10 model, a 10-pole, 600-volt unit operating at 75 hertz at 900 rpm. The companion alternator is a D14, a 16-pole unit supplying 215 volts at a frequency of 120 hertz and at 900 rpm. Type D77 traction motors are used, with standard 40-inch wheels. Type 26L air brakes are fitted. The unit weighs 390,000 pounds. It carries 395 gallons of lube oil, 295 gallons of cooling water and 40 cubic feet of sand, in addition to 3,000 gallons of diesel fuel. CSXT does not distinguish the SD40M-2 units from the regular SD40-2 units in the numbering scheme.

SD40-E3

The SD40-E3's, or SD33ECO's, were repowered with an EMD12-7120 prime mover. It was rated at 3,300 horsepower and met EPA Tier 3 emissions regulations. It also got updates in its cab, electrical, and mechanicals.

SD45

The SD45 models were an extension of the SD40 models, with more cylinders to increase horsepower. The prime mover is a 3,600-horsepower, 20-cylinder, 645E3 engine. The prime mover drives a AR10B-4 alternator, which feed the D77B traction motors, each rated at 1,050 amps. In practice, it was found that the maintenance disadvantages of 20-cylinders overshadowed the advantage of the 600-horsepower gain. Many of these units were re-engined with 16-cylinder power plants by various rebuilders. In effect, this makes them into SD40s. Dash-2 models were introduced in 1972. The SD45 series offered a refined Flexicoil truck and composition brake shoes. These units were 65 feet, eight inches long and carried 4,000 gallons of fuel. The Dash-2 units had a frame length of 68 feet, ten inches, for the HT-C trucks. EMD rolled out a total of 1,260 units from 1965 through 1971. The SD45 units were rated for a maximum continuous tractive effort of 82,100 pounds at 11.3 mph.

These units were used by CSXT predecessors SCL (SBD) and Clinchfield. SD45 units, numbered 8900-8944, came from SCL 2000-2044. SD45-2 units 8950-8982 came from SCL 2045-2059 and CRR 3607-3624. Three SD45-2 units were still rostered by CSXT in 1998 -- numbers 8952, 8954 and 8972. Unit 8952 was in a black paint scheme, but was repainted into CSXT *Bright Future*. These units were rated at 83,100 pounds of tractive effort at 11.3 mph. The SCL units weighed 384,000 pounds, with the CRR units being one ton more. The SCL units had standard dynamic brakes and the CRR units had extended-range, tapered dynamic brakes. The three remaining units saw helper action on the B&O Sandpatch Grade near Hyndman, Pennsylvania, in Spring 1999. They were equipped with the HelperLink. CSXT gained several more SD45 units from Conrail, and they were be renumbered into the fleet, starting with 8973.

SD45-2 units converted to SD40-2 models by CSXT include 8971, renumbered 8262 and 8973 renumbered to 8263. 8972 was a ex-Seaboard unit.

SD45

road number	weight	brakes	predecessor
8900-8909	368,000	standard dynamic brake	
8910-8923	377,000	standard dynamic brake	
8924-8937	388,000	standard dynamic brake	
8938-8944	387,000	extended	
SD45-2			
8950-8964			SCL 2045-2059
8965-8974	387,000	extended	

8966-8973	387,000	ext; tapered	CRR 3608-3615
8974-8982			SBD

ex-Clinchfield, ex-Seaboard unit CSX 8969 became the Huntington Shops Load Test Unit. These units could use the dynamic braking units as a simulated load.

SD50

The SD50 was the first of EMD's third-generation locomotives to find their way into CSXT service. One hundred and forty-three units came to CSXT from the Seaboard, C&O and B&O. They were numbered 8500 to 8552, the same numbers they carried as SBD units. A total of 407 units were manufactured by EMD from 1981-1985. The prime mover is a 3,500-horsepower, 16-cylinder, 645F engine driving an alternator. The AC current produced is rectified to DC before being applied to the conventional DC traction motors. Later modifications upped the horsepower to 3,600 and most of the early units had this retrofitted. These and subsequent SD units have K-band radar as part of the wheel-slip detection system. The radar unit, located in the front truck, measures the ground speed of the locomotive.

These units weigh 389,000 pounds and develop 96,300 pounds of tractive effort at 9.8 mph. They use the 70:17 gear ratio and have extended-range dynamic brakes. They carry a 3,900 gallon fuel tank and were equipped with flange oilers by CSXT.

CSX unit 8595, ex-B&O 8595, has the distinction of being the last new diesel locomotive delivered to the B&O.

The C&O units were found to overheat in tunnels. As part of the fix, the air cooled air compressors were replaced with water cooled units. The SD50s were also prone to electrical problems and coolant leakage. The early C&O units (8553-8575) came with D82 traction motors, which allowed more current capacity. The C&O

units also showed a better fuel economy than the early SBD units, due to the switch to the 645F3 prime mover.

The 144 CSXT SD50 units were overhauled in 1990. Eighty-five of these were done at the EMD plant and EMD supplied 59 kits to Huntington to do some work there. The consecutive numbering of the Chessie (B&O and C&O) units and the SBD units because they were ordered jointly for the separate companies by what was to become CSXT.

SD50-2

CSXT gained more than 50 of the Conrail SD50 units. These were numbered starting with 8644. Since the beginning of the SD60 numbering precluded more than 56 new units.

Units	predecessors
8500-8552	SBD (same numbers)
8553-8575	C&O (same numbers)
8576-8595	B&O (same numbers)
8596-8623	SBD (same numbers)
8624-8643	C&O (same numbers)

Other units came from the Conrail merger.

As of this writing, there are some 22 SD50's on the roster, Derated to 3,000 hp for MoW service. Concerning retirements, 6 units went to the Lake State Railway in Michigan, 4 went to the Reading & Northern, 6 to KK Recycling in Minneapolis, 2 to Metro East Industries in Illinois, and 126 to LTEX.

Road Slugs

A slug has no operator cab, but is controlled from another locomotive, called the “mother.” This allows 1 crew to operate two locomotives. CSXT originally had a series of road slugs built from

GP30's, GP35's and a single GP40. The first group was numbered from 2200 to 2279, the second group 2280 to 2387. All were painted in CSX's all-gray paint scheme when converted. Most have since been repainted into a standard CSXT *Yellow-Nose* scheme. CSXT acquired more slugs from rebuilder VMV in Paducah, Kentucky, in 1998. These will came from GP38 and GP40 models, and are called the *RoadMates*.
The CSXT style of road slug retains the fuel tanks (2,500-2,600 gallons) and can supply fuel to the attached mother unit. The slug also retains the control stand and toilet, and can lead a consist. They do not have a prime mover, but receive electrical power from the attached mother unit. Dynamic brakes are typically retained. The slugs started out mated with specific mother units, but this practice was not always followed. GP40-2s numbered 6400-6483 were used as slug mothers for the first group of slugs, 2200-2279. The second group of slugs, 2280-2330, entered service near the end of the year 1990 and were paired with GP40-2 mother units 6484-6499 and 6900-6943. The RoadMates were paired with GP38-2 mother units. GP38-2 numbers 2500 and 2502 were among the first group to receive the necessary equipment to be mothers, at VMV.

Slugs can retain their prime mover, or can get electrical power from the mother units. If the prime mover is removed, usually concrete ballast is added to balance out the tractive effort. Each mother unit has to be modified to control the slug as well. Mother-slug are usually paired and always work together. The slug can also be put in front, and control the trailing mother unit. Crews prefer this, as the slug is quieter. On the flip side, the cabin heaters in slugs don't work nearly as well.

With the prime mover removed, the need for access from the side of the unit is reduced. Visually, the slugs can be distinguished by the side doors being sealed and smoothed. Only the access doors below the dynamic brake grids remain functional. Cooling fans for the engine radiators were no longer needed and were removed as well. Weight translates to tractive effort, and the slugs are ballasted with concrete to make up for the missing prime mover. They weigh in around 262,000 pounds The minimum continuous speed of the mother-slug combination is 8.4 miles per hour and the slug unit does not produce tractive effort above 24 miles per hour.

The mother unit has a select-able fuel gauge, switchable between unit "1" (mother) and unit "2" (slug). With the fuel transfer switch in the automatic position, fuel is transferred from the slug's tanks to the mother when the fuel in the mother unit is 200 gallons or less than in the slug. This transfer only takes place when the unit is idling. In manual mode, the fuel can be transferred until the mother unit's tanks are full. In the second group of slugs produced, the 200 gallon trip point was changed to 600 gallons. The slugs were equipped with a system to manually activate the slug's fuel pump, in the event the mother unit ran out of fuel. The pump was powered from the main unit's batteries.

These slugs were converted at one of three locations: Morrison-Knudsen (M&K, I) in Idaho, Morrison-Knudsen (M&K-P) at Mountain Top, Pennsylvania, or at Precision National (PN) in Illinois. Units from the M&K Mountain Top division are considered model S51BDE. Western Maryland GP35 units 501 and 505 became CSXT slugs 2311 and 2295. The following table shows ex-B&O units (GP9, GP35 and GP30) converted to slugs. Other slug's came from ex-C&O units.

GP40-2's were used as mothers for the slugs.

CSX has retired three of the road slugs, and sold them to LTEX. These included 2214, 2225, and 2296.

CSXT
Units
converted
to slugs

road number	CSXT number	original	old number	type	by
2200	4384	B&O	3544	GP35	PN
2201	4135	B&O	6968	GP30	PN
2202	4399	B&O	3559	GP35	PN
2203	4421	B&O	3581	GP35	PN
2204		C&O	3560	GP35	PN
2205	4388	B&O	3548	GP35	PN
2206	4380	B&O	3540	GP35	PN
2207	6723	SCL	1568		
2208	4130	B&O	6959	GP30	PN
2209	4356	B&O	3516	GP35	PN
2210		C&O	3010	GP30	PN
2211	4116	B&O	6915	GP30	M&K, I
2212	4391	B&O	3551	GP35	PN
2213		C&O	3530	GP35	PN
2214		C&O	3529	GP35	PN
2215	4350	B&O	3510	GP35	M&K, I
2216	4133	B&O	6966	GP30	M&K, I
2217	4122	B&O	6934	GP30	M&K, I
2218	4408	C&O	3568	GP35	PN
2219	4341	B&O	3500	GP35	M&K, I
2220		C&O	3538	GP35	PN
2221	4396	B&O	3556	GP35	M&K, I
2222	4381	B&O	3541	GP35	M&K, I
2223	4345	B&O	3505	GP35	M&K, I
2224		C&O	3520	GP35	PN
2225	4106	B&O	6901	GP30	M&K, I
2226	4112	B&O	6909	GP30	M&K, I
2227	4140	B&O	6974	GP30	M&K, I
2228		C&O	3566	GP35	PN
2229	4344	B&O	3503	GP35	M&K, I
2230	4379	C&O	3539	GP35	PN
2231	4302				
2232	4128	B&O	6949	GP30	M&K, I
2233	4118	B&O	6922	GP30	M&K, I
2234		C&O	3572	GP35	PN

2235		C&O	3564	GP35	PN
2236			744		
2237	4349	B&O	3509	GP35	M&K, I
2238	4343	B&O	3502	GP35	M&K, I
2239	4383	B&O	3543	GP35	M&K, I
2240	4366	C&O	3526	GP35	PN
2241	4108	B&O	6903	GP30	M&K, I
2242		C&O	3031	GP30	PN
2243	4137	B&O	6970	GP30	M&K, I
2244					
2245	4347	B&O	3507	GP35	M&K, I
2246	4115	B&O	6913	GP30	M&K, I
2247			1411		
2248	4111	B&O	6908	GP30	M&K, I
2249	4113	B&O	6910	GP30	M&K, I
2250			2274	GP30	
2251			2253	GP30	
2252			2251	GP30	
2253			528	GP30	
2254			524	GP30	
2255			511	GP30	
2256			508	GP30	
2257			530	GP30	
2258			2265	GP30	
2259			506	GP30	
2260			520	GP30	
2261			2254	GP30	
2262			2272	GP30	
2263			2278	GP30	
2264			510	GP30	
2265	4107	B&O	6902	GP30	M&K, I
2266	4116	B&O	6911	GP30	M&K, I
2267	4126	B&O	6945	GP30	M&K, I
2268	4129	B&O	6958	GP30	M&K, I
2269	4139	B&O	6972	GP30	M&K, I
2270			1352		

2271	4105	B&O	6900	GP30	M&K, I
2272	4138	B&O	6971	GP30	M&K, I
2273	4109	B&O	6905	GP30	M&K, I
2274	4413	C&O	3573	GP35	PN
2275	4414	C&O		GP35	PN
2276	4401	C&O	3561	GP35	PN
2277	4403	C&O	3563	GP35	PN
2278	4405	C&O	3565	GP35	PN
2279	4409	C&O	3569	GP35	PN
2280	4119	B&O	6926	GP30	M&K, P
2281					
2282	4386	B&O	3546	GP35	M&K, P
2283	4121	B&O	6930	GP30	M&K, P
2284	4358	B&O	3518	GP35	M&K, P
2285	4134	B&O	6967	GP30	M&K, P
2286	4392	B&O	3552	GP35	M&K, P
2287	4102	C&O	3021	GP30	M&K, P
2288	4365	C&O	3525	GP35	M&K, P
2289	4110	B&O	6906	GP30	M&K, P
2290	4390	B&O	3550	GP35	M&K, P
2291	4371	C&O	3531	GP35	M&K, P
2292	4123	B&O	6936	GP30	M&K, P
2293	4372	C&O	3532	GP35	M&K, P
2294	4117	B&O	6921	GP30	M&K, P
2295	3580	WM	3580	GP35	M&K
2296	4124	B&O	6937	GP30	M&K, P
2297	4374	C&O	3534	GP35	M&K, P
2298	4120	B&O	6927	GP30	M&K, P
2299	4389	B&O	3549	GP35	M&K, P
2300	4136	B&O	6969	GP30	M&K, P
2301	4368	C&O	3528	GP35	M&K, P
2302					
2303	4395	B&O	3555	GP35	M&K, P
2304	4407	C&O	3567	GP35	M&K, P
2305	4367	C&O	3527	GP35	M&K, P
2306	4402	C&O	3562	GP35	M&K, P

2307	4355	B&O	3515	GP35	M&K, P
2308	4132	B&O	6964	GP30	M&K, P
2309	4217	C&O	3023	GP30	M&K, P
2310	4353	B&O	3513	GP35	M&K, P
2311	3576	WM	3576	GP35	
2312	4104	C&O	3041	GP30	M&K, P
2313	4359	B&O	3519	GP35	M&K, P
2314	4362	C&O	3522	GP35	M&K, P
2315	4375	C&O	3535	GP35	M&K, P
2316	4342	B&O	3501	GP35	M&K, P
2317	4385	B&O	3545	GP35	M&K, P
2318	4346	B&O	3506	GP35	M&K, P
2319	4415	C&O	3575	GP35	M&K, P
2320	4097	C&O	3007	GP30	M&K, P
2321	4410	C&O	3570	GP35	M&K, P
2322	4131	B&O	6960	GP30	M&K, P
2323					M&K
2324					M&K
2325	4411	C&O	3571	GP35	M&K, P
2326					M&K
2327					M&K
2328					M&K
2329					M&K
2330	4423	C&O	3583	GP35	M&K, P

abbreviations:
M&K, I = Morrison-Knudsen, Boise, Idaho.
M&K, P = Morrison-Knudsen, Mountain Top, Pennsylvania.
PN = Precision National, Mount Versno, Illinois.

CSXT absorbed some of Conrail's MT-4 and MT-4 slugs. These were renumbered into the 10xx series.

Units 2214 and 2296 were sold to LTEX as this book was being finished up. Unit 2225 went to Progress Rail. CSX has 172 Road Slugs on the roster.

Road Mates

Arriving in 1998 were newer slugs built from GP38 and GP40 models, called *RoadMate*. The designation is stenciled beneath the cab window. These are produced at VMV in Paducah, Kentucky. The initial order from CSXT in 1998 is for 30 units. The dynamic brakes are retained in there models, as are the cab controls. Road numbers are in the range 2331-2350.

Yard Slugs

These units operate at limited speeds and for short distances. They do not have fuel tanks, nor dynamic brakes. Units 1010-1029 were converted from Chessie GP7 and GP9 units. Units 1038-1050 were from B&O 138-T and 139-T and C&O 140-T through 150-T. These units weighed 247,000 pounds and used the 62:15 gear ratio. They achieved a 45,000 pounds tractive effort, at 6.0 mph. B&O 138-T and 139-T were rebuilt at Cumberland, for service at Queensgate Yard, Cincinnati. The 138-T unit was ex-B&O 6418 (5618), a GP7, using parts from the Western Maryland slug 138-T, which had been scrapped. Unit 139-T was ex-B&O 6420 (5620), also a GP7. Ex-Western Maryland slug 139-T resides in the B&O Museum at Mt. Clare. The "-T" stood for “trailer uni”t on the WM, a nicer name than *slug*.

Mothers for the B&O 138-T and 139-T units were B&O SD35s, rebuilt into SD20-2s. The C&O converted eleven GP9 models to slugs at the Huntington Shops. The mothers were GP39s. These all came over to CSXT with renumbering. The C&O units had the headlamp and numberboards on the rear only. A C&O mother could handle two slugs and the C&O slugs were wired to support a second unit. CSXT 1018 was renumbered 1056. GP38-2 units 2500-2529 were modified to serve as slug mothers for slugs 1010-1029. The combination of a GP38-2 and its slug is considered equivalent to a pair of GP38-2's in yard service. There is a minimum continuous speed rating of six miles per hour and the slug does not produce tractive effort above 25 miles per hour. A slug unit can be isolated but not disconnected by road crews. The slug units do not have wheel-slip control.

The SWMT-class slugs from GP-9's, ex-Conrail, went to CSX.

For the yard slugs the slug mother was a SD40-2, with the necessary modification kit installed. An example would be SD40-2 road number 2419, ex-8170.

number	old	origin	number	model	convert.
1010	574	B&O	6574	GP9	PN
1011	519	B&O	6519	GP9	PN
1012	209	C&O	6209	GP9	PN
1013			5890	GP9	
1014	224	C&O	6220	GP9	PN
1015		C&O	6262	GP9	PN
1016	282	C&O	5951	GP9	PN
1017	343	C&O	6031	GP9	PN
1018	341	B&O	6029	GP9	PN
1019	492	B&O	6492	GP9	PN
1020	491	B&O	6491	GP9	PN
1021	477	B&O	6477	GP9	PN
1022	215	C&O	6214	GP9	PN
1023		C&O	6239	GP9	PN
1024	315	C&O	6225	GP9	PN
1025		C&O	6198	GP9	PN
1026	225	C&O	6223	GP9	PN
1027			6258	GP9	
1028		C&O	5993	GP9	PN
1029	471	B&O	6471	GP9	PN
1038	-	B&O	138T	GP7	Cumb.
1039	-	B&O	139T	GP7	Cumb.
1040	140T	C&O	6211	GP9	Hunt.
1041	141T	C&O	6227	GP9	Hunt.
1042	142T	C&O	6062	GP9	Hunt.

1043	143T	C&O	5946	GP9	Hunt.
1044	144T	C&O	6215	GP9	Hunt.
1045	145T	C&O	6136	GP9	Hunt.
1046	146T	C&O	6143	GP9	Hunt.
1047	147T	C&O	6013	GP9	Hunt.
1048	148T	C&O	6036	GP9	Hunt.
1049	149T	C&O	6186	GP9	Hunt.
1050	150T	C&O	6168	GP9	Hunt.

Numbers in the range 1010-1028 were renumbered 1051-1062 by CSXT. There were 33 units rostered by CSXT in 1998, in the road number range 1021-1068. The length of time these units remain in service as slugs shows the major maintenance item is the prime mover.

Renumbering by CSXT

Old	New
1010	1051
1011	1052
1016	1053
1012	1054
1013	1055
1018	1056
1017	1057
1028	1058
1027	1059
1014	1060
1015	1061
1025	1062
1039	1063
1038	1064
1029	1065
1020	1066
1019	1067
1026	1068

GE locomotives from predecessor roads

CSXT rostered a total of 11 types of GE locomotives from predecessor roads. These included various models of the venerable U-boats and some Dash-7 models.

The U-boats

This is GE's 'U' or Universal series, first-generation diesels. The two digits indicate the horsepower, in hundreds. 'B' indicates four-wheel trucks and 'C' indicates six-wheel trucks. The FDL-16 engine is used in the U25B and subsequent models. This is a 16-cylinder, four cycle prime mover, a Cooper-Bessemer design. The horsepower rating of this engine went from 2,500 to 4,000 over 28 years of production.

The U-boats use a 74:18 or 81:22 gearing, giving a maximum speed of 70 or 75 mph. Late U30s and U33s introduced the ROC (rate-of-change) wheel-slip system, with auto-sanding. On a U-boat model, the main electrical compartment is under the left side of the cab floor, with the air brake compartment under the right floor.

The U-boats use the GE-752 traction motors with 40 inch wheels. They are equipped with the 26L air brake system.

All U-boats are gone from CSX service.

U18B

These 1,800-horsepower units feature a V-8 prime mover. They are 54 feet, eight inches long and use a 81:22 or 74:18 gear ratio. They do not have dynamic brakes and they use E-type couplers. For the U. S. market, 118 U-18B units were built between 1963 and 1976. One hundred and three U18B units came to CSXT from predecessor SCL. SCL and other lines had traded-in first-generation EMD power for the U18Bs. Numbered 1888-1990 on CSXT, they were previously SCL 250-261 and 300-392. All are now retired from mainline service. Nine units went to MoW service and were renumbered 9500-9508.

The U18B developed 54,100 pounds of tractive effort at 9.4 mph. There was some weight variation among the units, ranging from 240-243,000 pounds. They had fuel tanks of 2,150 gallons capacity, with 160 gallons of oil, 330 gallons of water, and 60 cubic feet of sand. Units 1888-1899 weighed some 20,000 pounds less than their sister units, due to smaller fuel tanks (1,200 versus 2,150 gallons) and less ballasting. The lighter units (ex-SCL) were intended for service on light duty branch lines.

U23B

The U23B was intended to compete with EMD's GP38. CSX's U23B units, numbered in the series 3200-3324, came from predecessor roads C&O and L&N. They had a 2,250-horsepower, 12-cylinder prime mover. Most used the 74:18 gear ratio, with some having the 83:20. The capacities for these units were 60 cubic feet of sand, 300 gallons of lubricating oil and 350 gallons of cooling water. Fuel tank capacity varied from 2,750 to 3,520 gallons. A total of 425 units were built for the U.S. market from 1968 through 1977. The units weigh 277,000 pounds and develop 60,400 pounds of tractive effort at 10.8 mph.

The C&O U23B units used Blomberg trucks from EMD units traded in to GE. They also had the fixed side windows in the cab plated over, rather than replace the glass with FRA-specified certified glass, as a cost savings technique. Seventeen of the C&O units went to GE as a trade-in on B36-7's for the Seaboard. The rest went into regular service in Chessie paint. Unit 3225 was in CSXT stealth gray, and unit 3293 sported Bright Future paint. Units coming to CSXT from the SBD were acquired by that line from its predecessors Monon and L&N.

CSXT had three of these units in regular service on the Florida phosphate run in 1997, as units 3292, 3303, and 3305. In addition, there were six units rostered in Maintenance of Way service as road numbers 9550-9555. The last U23B in CSXT mainline service was 3305, an ex-C&O unit.

The DASH-7 line

These second-generation units were produced from 1976-1988. As with the U-boats, a B model had two-axle trucks and a C model had three-axle trucks. They feature an AC alternator in place of the generator common in the U series. The traction motors remain DC. The prime mover remains the FDL-16, now turbocharged and intercooled. The Dash-7 locomotives can be equipped with a toilet. Most have the AAR control stand. They do not have the microprocessor-based electronics.

B models have a 2,250-gallon fuel tank, whereas the C series get a 3,250-gallon tank. The Dash-7 models have 60 cubic feet of traction-enhancing sand storage capacity in the short hood.

B23-7/BQ23-7

These units have a 2,250-horsepower prime mover of 12-cylinders. They were 62 feet, two inches long. Four hundred and eleven of the B model were built from 1977 through 1984. The BQ model featured the larger Quarters Cab. This had extra space for the conductor, as the use of cabooses was being phased out. The BQ model was built from 1978 through 1979. CSXT’s BQs, numbered 3000-3009, came from SCL units numbered 5130-5139. These were built in late 1978 to early 1979, the only BQ models built. The fuel tank capacity was 2,930 gallons. In 1996 and 1997, these units could be found with the windows plated over, in service as 'B' units.

The B23 units, numbered 3100-3143, came from SCL 5100-5114, L&N 5115-5129 and SCL 5140-5154. They could have 81:22, 74:18, or 83:20 gearing. They weighed in at 266,000 – 269,000 pounds. These units had the extended-range dynamic brakes. These units had a 60,400 pound maximum continuous tractive effort rating at 10.8 mph. Fuel tank capacity ranged from 2,750 to 3,000 gallons.

In 1995, 14 of the units were retired, but shortly brought back onto the roster. In 1997, CSXT rostered 40 of the B model and four of the BQ model. This was down to 18 units in 1999. Unit 3134 went to Maintenance of Way service as unit 9556. CSXT acquired about 50 of these units from Conrail. They were renumbered starting with 3144. CSXT also got some of the Conrail B23-7R models, with the "R" designating rebuilds. CSX has disposed of all these units.

B30-7

The B30 is an uprated B23, with a 3,000-horsepower prime mover. About 200 of this models were built from 1977 through 1981. All had the AAR "clean cab" for safety and the toilet was in a compartment in the main body, not in the short hood. Lubricating oil capacity was 300 gallons with 250 gallons of cooling water and 60 cubic feet of sand. CSXT units in the number range 5500-5580 were previously SCL 5500-5516. These units weighed in at 266,000 pounds, used the 81:22 gear ratio and developed 54,100 pounds of tractive effort at 12 mph. The ex-C&O units 8235-8298 (renumbered 5517-5580) weighed 277,500 pounds, had the 74:18 gear ratio and developed 64,200 pounds of tractive effort at 11.3 mph. (Units 8265-8298 had the new 752AF traction motors, with 83:20 gearing). The B30-7 models had extended-range dynamic brakes and a 3,550 gallon fuel tank. These used the GE 752 traction motors, rated at 1,260 amps continuous. They had the standard 27-pin MU cabling.

The C&O units came with Nathan K5LA horns. Units 8235-8278 had flat dynamic brakes. Units 8279-8298 had extended-range dynamic brakes. Units 8235-8244 used the FB2 floating bolster trucks. All the other units had the AAR trucks. Seventy-nine of eighty units remained on the CSXT roster in 1999. Retired unit 5521 was spotted in early 1999 with a new road number – *0000*! No one seems to know the significance. All CSX B30-7's have been retired.

B36-7

This model featured a 3,750-horsepower, 16-cylinder prime mover driving an alternator. They were 62 feet, two inches long. They carried 3,150 gallons of fuel, 380 gallons of lube oil and 365 gallons of cooling water. The B36-7 model was built from 1980 through 1985. CSXT numbers 5806-5925 wore the same numbers on SBD. (Units numbered 5800-5805 were U36Bs.) They weighed 274,000 pounds and used the 83:21 gear ratio. They developed 64,600 pounds of maximum continuous tractive effort at their type F couplers at 12 mph. They were considered high-adhesion locomotives, due to their active control of wheel-slip. The units were equipped with extended-range dynamic brakes and flange oilers. Unit 5859 was involved in a wreck with a Union Pacific locomotive in Mitchell, Indiana, in 1994, but was returned to service. CSXT acquired more than 20 of the Conrail B36-7s. They were renumbered lower than the current road numbers of the CSXT units, starting with 5783. No B-36's remain.

C30-7

The C30-7 is the three-axle version of the B30-7. They were built from 1976 to 1985. The locomotives were 67 feet, three inches long and have extended-range dynamic brakes. A 3,000-horsepower prime mover drove an alternator. The traction motors were DC, with 74:18 or 83:20 gearing. Weight ranges from 385,000 to 411,000 pounds. Fuel tanks held 3,900 to 4,000 gallons of fuel.

SBD units 7000-7094 were assimilated into the CSXT system from L&N and SCL with the same road numbers. CSXT got more than 20 C30-7A models from Conrail. No C30 models are still rostered.

Road number	weight	tractive effort
7000-7069	385,000	90,600@9.6 mph
7070-7094	411,500	91,500@9.5 mph

Pumpkins

CSXT converts its older, less reliable units into special Maintenance of Way power. These see yard duty as well and can sometimes be seen on the road in helper service during motive power shortages. They are not intended for revenue service and usually stay close to a maintenance depot. They are painted a distinctive orange color and are referred to as Pumpkins. They receive no updates and are retired when they experience a major failure.

In 1997, CSXT rostered 54 pumpkins. Most of these were GP38 and GP40 models. Unit 9600, the sole GP30m Pumpkin, was out behind the Cumberland Shops in Spring 1997, on the dead line retired from service. Units 9728, 9714, and 9716 were hanging out at the VMV Shops in the summer of 1998.

Units 9650-9664 are GP38s and 9700-9728 are GP40 models. Unit 9703 is ex-6856, ex-RF&P 122 and 9726 is ex-6860, ex-RF&P 126. These units are unusual in not having dynamic brakes.

GP38-2 pumpkin 9699 has the distinction of having been numbered 2002 in a previous life, the *All-American Diesel,* by Trains magazine. It resides at the B&O Museum in Baltimore.

In spring 1997, extensive flooding occurred along the Ohio River. Engine 9721 suffered water damage after becoming stranded east of Louisville on CSXT's LCL Subdivision. The locomotive was partly submerged and was later towed to the Corbin Shops for evaluation. It was sold at auction to a shortline. Members of CSX's pumpkin fleet were sold to shortlines over the years, and orange paint is missing from the road.

U18B	previous	U23B	previous	B23-7	previous
9500	1984	9550	3242	9556	3134
9501	1977	9551	3257		
9502	1918	9552	3288		
9503	1889	9553	3318		
9504	1926	9554	3301		
9505	1981	9555	3265		
9506	1947				
9507	1949				
9508	1932				

GP38	previous	GP40	previous	GP40	previous
9650	2100	9700	6582	9715	6739
9651	2120	9701	6579	9716	6752
9652		9702	6619	9717	6587
9653	2159	9703	6856	9718	6634
9654	2035	9704	6609	9719	6810 (retired)
9655	2187	9705	6524	9720	6792
9656	2036	9706	6696	9721	6625(retired)
9657	2006	9707	6694	9722	6567 (retired)
9658	2122	9708	6655	9723	6516 (retired)
9659	2025	9709	6586	9724	6632
9660	2109	9710	6764	9725	6645
9661	2180	9711	6584	9726	6860
9662	2118	9712	6772	9727	6680
9663	2004	9713	6784	9728	6778
9664	2152	9714	6762	9729	6576
9665	2145			9730	6522
9666	2014			9731	6705
9699	2002				

Fuel Tenders

CSXT experimented with fuel tenders to extend the range of its locomotives. The concept revolved around the use of a 62 foot tanker, sandwiched between two locomotives. With special fittings and hoses, the tanker could keep the locomotives' fuel tanks full, which is useful to generate maximum traction (a function of unit weight). The tankers were tested with specially modified AC4400 series locomotives, specifically unit 30. One such tanker was numbered CSXT 993368 MW.

The tenders, modified from standard tank cars,did not include internal baffles. Tankers are typically shipped either fully full or fully empty to avoid problems with fluid slosh during acceleration or braking. This became a problem in fuel tender use, with partially empty tanks.

They were tested on a train moving coal from West Virginia to the generating plant of Seminole Electric. The coal came down the Ohio River on barges. It went by rail to Jacksonville, where it was delivered to the electrical generating station at Boswick, and the previous day's empties then went back to Chatahoocee for delivery to Port St. Joe. The water-borne portion was also provided by CSX subsidiary American Commercial Barge Lines. The purpose of the fuel tenders was to allow weekly, not daily fueling. The operation was active for only a year or so. Now, the coal moves totally by rail.

MU and Consisting

One of the advantages of the diesel locomotive is that multiple units can work together, controlled from a single station. It is safe to say that modern locomotives, even from different manufacturers, can be lashed up together. If you suspected that this is not only not an accident, but wasn't always the case, you would be correct. For example Baldwin locomotives could not operate with other manufacturer's units because they had pneumatic controls; all other manufacturers used electrical controls for their locomotives.

Due to industry-wide standardization, units from different manufacturers can be used together and controlled from one cab. CSXT rules allow up to 12 locomotives to be operated together in a consist, but the train tonnage is limited to that of the maximum rating of five GP40-2 units. More tractive effort than that could result in pulled drawbars and broken coupler knuckles. Older units with operating or wiring idiosyncrasies have mostly been retired from the fleet.

The classic counterexample of being able to hook up units from different manufacturers is the Westinghouse air throttle, used on Baldwins and other units. It gave an infinitely variable speed control, at the cost of compatibility. Luckily, CSXT does not roster any Baldwin units. The standard now for interoperability is approved by American Association of Railroads (AAR) and used by all major North American railroads, such as CSXT.

Consisting is the set of operation rules that specify what units can operate together, in what order and under what restrictions. It is rare that the power desk has a matched set of identical units available at a given location and given time.

The eight-notch throttle is the norm in North American railroading, but, you ask, doesn't a GP15 produce less horsepower at notch six than does a CW4400? Of course. But, the throttle and engine control is designed to produce a certain percentage of maximum available power for each notch position. Thus, all units load share properly (when everything is working right). Throttle settings are specified by four electrical signals, in the control cable between units. This system was developed by GE in the 1930s and became the industry standard. We have noted that AC units do not have the complication of *transition*. In recent DC units, transition is automatic. Older units with manual transition must not be used in a consist (except as the lead unit).

The modern connection between locomotives for control is the MU-27 pin electrical connection. Of the many systems in use in the 1940s, the MU-27 became the standard. In addition to the electrical cable between units, multiple air hoses bridge the units as well. One air line is the independent or locomotive brake. Another three air lines on either side of the coupler coordinate the air brakes. With 26L, these are main air reservoir, actuating and application/release. Variations are possible. With each units' air compressor contributing to the air, brake recharging is quicker and more reliable. Most units on CSXT today have the 26L brake system. The brakes are controlled from the lead unit, with trailing units selected via the in-cab MU-2A valve to the *trail* position.

A thick jumper cable is used to connect the MU-27 pin plugs on adjacent units. This cable is about six feet long to allow it to bridge the gap between locomotives. Due to the size of the wiring, the assembly weighs about 40 pounds. Control circuits use 74 volts direct current. Pins eight and nine (of 27) control direction, pin eight for reverse and pin nine for forward. All units must agree which direction is forward and which is reverse. Typically on CSXT, the short hood is forward and this is marked with an "F" on the frame. Pins eight and nine are reversed electrically between the connections on the front and the back of the unit. Older units may have modified connections in the MU-27 wiring and just because a cable fits, doesn't mean it will work correctly.

The engineer in the lead unit has to control not only the throttle position on all of the units, but the sanding, the air brake pressure, the dynamic brake setting, etc. Warnings and alarms come back to the controlling cab. Even the rare unit without dynamic brakes must pass the control through to trailing units. Otherwise, non-dynamic brake units would be restricted to the end of the consist.

Trainlined alarms give the engineer in the front cab an indication of pending problem in trailing units. This could be a wheel-slip indication, a dynamic brake warning, or an over-temperature warning.

The particular problems with AC units being “too good” are also apparent. CSXT specifies that in mixed consists, the AC units should not lead. Ideally, the least capable unit should lead. Thus, it will set the pace for acceleration and braking. Unfortunately for road crews, the least capable unit usually has the most uncomfortable cab. Crews like to have a road slug as a lead unit and the CSXT design allows this. With no prime mover, the slug has a very quiet cab, with little vibration.

There are technological solutions to the mixed power problems, but these are still in development. A sufficiently clever computer control in the lead unit could adjust for any trailing unit.

The following locomotive models were acquired by CSXT from Conrail.. These were new models for CSXT, as they had no operational or maintenance experience with these units.

Locomotive Servicing

The differences between the locomotives from the two manufacturers are enough that CSXT, as with other roads, uses separate facilities to service them. These facilities specialize in one manufacturer or the other and have the necessary shop skills and spare parts on hand. Minor repairs and servicing can be done on any locomotive at the various shops. CSX repair shops include Huntington, West Virginia; Cumberland, Maryland; Corbin, Kentucky (?), Waycross, Georgia(?) and Huntington (?).

It is not unusual for locomotives to have a 40 year service life and they may be rebuilt multiple times. Traction motors as well as the prime movers are rebuilt. New air compressors, fans and other auxiliary equipment are periodically replaced. Wheels are reground to preserve their contour and replaced as necessary. New cabs can be fabricated. If the frame isn't bent, the locomotive can still provide service. The goal for locomotive servicing is to achieve a mean time between failures (MTBF) of 90 days. Thus, a locomotive won't need to come in to the shops between normal 90-day inspections.

EMD Servicing - Cumberland Shops

The CSXT shops located in Cumberland, Maryland, specialize in the maintenance of EMD type locomotives. These shops occupy the old B&O steam engine maintenance facility in South Cumberland. Besides the classification yards and car shop building, there is a locomotive maintenance building, a paint shop and a turntable. The facility is also the location of the CSXT Engineer’s school and the headquarters of the Cumberland Coal Business Unit. In addition EMD servicing is done at the Huntington Shops in West Virginia.

Locomotive servicing can be as simple as a 90-day inspection, or as complex as a change-out of traction motors, trucks, a power pack, or the entire prime mover. Miscellaneous electrical and mechanical work is done, in addition to painting. Wheels can be trued in the shop. The large overhead crane can be used to lift the body off a locomotive for more serious access to the components.

Each shop has a defined work flow, to minimize the amount of time the locomotive is out of revenue service. Units entering the shops are washed, then moved to a particular work station, depending on the servicing to be done. Sufficient parts are stockpiled such that a unit is not kept waiting for a filter, for example. For rapid turn-around, spare assemblies can be substituted for failed or worn assemblies. For example, a locomotive might have its traction motors replaced with rebuilt units, while the removed units go for rebuilding. An entire truck, consisting of multiple axles and traction motors and the associated brake gear might be replaced. A supply of rebuilt assemblies is kept on hand for rapid change-out.

Special work sites are used for air brake work, traction motor rebuilding, wheel truing, radiator repair, power pack repair, electrical testing and refurbishment, fuel injection system repair and the like. Heavy welding repair might also be required on the frame or the trucks. Load testing is done in a designated area.

Painting and lettering is done in a separate facility, due to cleanliness requirements and the need for control of odor, fume,s and hazardous materials.

The flow of locomotive units within the facility is optimized with computer-based scheduling of work, based on the differing needs of arriving units. Some locomotives might need only a required periodic inspection, while others may have flaws in the prime mover, necessitating removal. The key to productivity of the shop is how quickly units can be returned to service.

Cumberland was also the site for CSXT's Engineering Training School. Here, candidates learned about locomotive systems, air brakes, train handling and operating rules. There is a required 2-day re-certification process for all engineers every three years.
Locomotives do not usually use antifreeze in their cooling systems, leading to the need to keep units idling in the winter, or drain the cooling system after shutting down. There are several reasons for this practice. First, the metallics in the older units were not compatible with some of the chemicals in the antifreeze available at the time. This is particularly true for the EMD 567 prime movers. Secondly, due to the large volume of coolant in the system (hundreds of gallons), the use of antifreeze would be expensive.

Thirdly, due to the relatively low fuel usage at idle, it is a reasonable trade-off to let units idle. In Canada, for example, locomotives typically are not turned off from early fall until late spring.

Another issue is that antifreeze leaking into the oil causes a big mess, with loss of lubricating quality and potential engine damage. The antifreeze chemical tends to mix with and degrade the oil, where water will sink to the bottom of the crankcase and not mix well (homogenize) with the oil. Generally, some water pump lubricant is the only chemical used with the cooling water.]

CSX's other servicing locations are Waycross, Georgia and Huntington, WV. GE servicing is done at Waycross, Huntington, was originally a C&O shop where Waycross was a former SBD facility.

Prime Movers

This section discusses the prime movers from the various locomotive manufacturers.

EMD Prime movers

The search for an adequate prime mover of sufficient power/weight was a major issue in the early days of diesel-electric development.

EMD-567

EMD's model 567 engine, introduced by Winton in 1938 used a 8.5-inch bore and 10- inch stroke. Twenty-five years later, these 2-cycle diesel prime movers had produced over 50 million horsepower. The 567 engine also found use in the World War II era Landing Ship, Tank (LST). The 645 engine, introduced in 1966, opened the bore to nine and 1/16 inches. The 710 engine of 1984 was a nine and 1/16-inch bore with an 11-inch stroke. These are all a two cycle design, with a 45-degree V format. A typical compression ratio is 16:1 (14.5:1 on some models). A ‘power pack’ refers to one piston and cylinder liner assembly. The capacity of this assembly, in cubic inches, becomes the model number of the engine. All EMD engines feature a Roots supercharger, or a turbocharger. EMD used GE electrical components through 1938. After that, they built their own electrical components. GM can currently produce between 380-400 locomotives a year.

The 567 engine had a maximum engine speed of 800-900 rpm.

EMD-645

The EMD645 prime mover from EMD comes in V6, V8, V12, V16, and V-20 configurations, with a total displacement of between 5,160 to 12,900 cubic inches. It was in production from 1965 through 1983, although a few units were built up until the 1990's. It was used (internationally) for locomotives, stationary applications, and marine use. The 16-cylinder version was used by GM's Terex truck Division. The 645 was a derivative of the earlier 567, with a cylinder bore increase (8 1/2” to 9 1/16”. The external size and configuration of the engine, as well as the weight, did not change. The crankcase was modified. A lot of 645 series parts can be retrofitted on the 567 series units. The model 567E used a 645E series block, but with 567 power assemblies.

All the 645 engines used a Roots supercharger, or a turbocharger. These are as useful clearing out the cylinder into the exhaust manifolds, as they are in cramming the maximum amount of air. The Roots blower is a positive displacement lobe pump with a series of meshing lobes. These are mostly used on two-cycle diesels.

The diesel engine was patented in 1892 by... Rudolf Diesel, in Germany. During the period through 1930, 4-cycle diesels were dominant. Two stroke diesels, advanced by Kettering of General

Motors Research, provided higher power-to-weight ratios. Two stroke diesel are simpler, but have problems meeting today's more stringent emissions standards. In EMD 2-stroke diesels, there are very few parameters that can be adjusted. Injection and exhaust valve timing can be adjusted, to maximize combustion gas exhaust, and input air. There is a single camshaft for the exhaust valves and the Unit ejector, the direct fuel injector.

EMD, as well as other manufacturers, have made the move to four stoke prime movers, to be in compliance with the more stringent EPA Tier-4 standards.

In the MD design, the power stroke begins at top dead center (TDC). Fuel injection leads TDC by 4 degrees of rotation of the camshaft. The power stroke duration is 103 degrees. The cylinder is scavenged from BDC-45 degrees, to BDC + 45 degrees. Turbochargers adds 50% more rated power over the Roots blower system. The compression stroke duration is 119 degrees. The 645 series has a maximum engine speed of 900-950 rpm. The cooling system is liquid.

The turbo model was used in the GP40, SD40, and SD45 in a 3,000 horsepower, 16 cylinder or 3,600 hp, 20-cylinder configuration. The GP-38 and SD38 got the roots supercharger equipped models, and the GP-39 and SD-39 used the turbocharged 12 cylinder model. There are four exhaust valves per cylinder. All engines past 1995 have electronic fuel injection.

The front of a 645 prime mover where the governor and fuel pump are located, is toward the rear end of the locomotive, adjacent to the coolant and cooling system. The rear of the engine, us at the front of the locomotive with the alternator. The rotation of the engine is clockwise, viewed from the front of the engine.

To get started, there are dual starting motors, parallel connected to 64 volts in earlier models, later models using series connected 32-volt starters.

Early engines without electronic fuel injection used Woodward PGE governors. This task was included in Electronic Fuel injection models.

EMD-710

The 710 series uses a turbocharger exclusively, since two roots blowers would be required, and there's not enough room. The 720 came along in the 1980's. The new engine retained the bore increase of the 645, with a stroke increase. Again, the exterior size did not change.

The 1984 16-cylinder model achieved 3,800 hp. That went to 4,500 hp in 2012. Most models are rated at 4,300 hp. The 12-cylinder engine proved popular for upgrade of older models with the 645 16-cylinder engine.

The engine comes in V-8. V-12, V-16, and V-16 configurations. They are all two stroke, and only use a turbocharger. This provides 50% more power over an identical unit with the Roots blowers.

EMD Prime movers by Locomotive model

Model	Horsepower	engine type	number of cylinders	
NW2	1,000	567A	12	
F3/F7	1,500	567B	16	
SW1200	1,200	567C	12	
SW1500	1,500	645E	12	
GP7	1,500	567B	16	
GP9	1,750	567C	16	
GP15/MP15	1,500	645E	16	
GP15T/MP15T	1,500	645	8	turbo

GP18	1,800	567D	16	
GP30	2,250	567D	16	
GP35/SD35	2,500	567D	16	
GP38/SD38	2,000	645E	16	
GP39	2,300	645E	12	turbo
GP40/SD40	3,000	645E	16	
SD18	1,800	567D	16	
SD45	3,600	645E	20	
SD50	3,500	645F	16	
SD60	3,800	710G	16	
SD70	4,000	710G	16	
SD80	5,000	710G	20	
SD90	6,000	265	16	

GE Prime Movers

From 1935, GE used diesels form Ingersoll-Rand. Early GE diesels used a Cummings diesel, starting around 1938. They began developing their own diesels around that time.

7FDL

The FDL series diesels came in 8-, 12-, and 16 cylinder models. This is a four-stroke unit, and was based on a CooperBessimer design. It started out being used in the U25, and went on to power the Dash-7, Dash08, and Dash-9 models, as well as the AC4400's.

The 4,000-horsepower (at 1,050 rpm), 16-cylinder 7FDL prime mover, with a 12.7:1 compression ratio and turbocharger. The engine idles at one of three speeds (340, 440, or 580 rpm), depending on temperature. The units are over 70 feet long, 15 feet, 4.5 inches high and a few inches over 10 feet wide. They weigh 395,000 pounds and hold 5,000 gallons of fuel, 385 gallons of cooling water, 410 gallons of lube oil and a total of 44 cubic feet of sand. The C40-8s use the 752AG traction motors and generate 108,600 pounds of maximum continuous tractive effort at 11 mph. The 83:20 gear ratio gives a top speed of 70 mph. The high-capacity, extended-range dynamic brakes can supply 79,000 pounds of retarding force down to six miles per hour.

GEVO

The evolution series GEVO series comes in 6-, 12-, and 16-cylinder engines, in a 45-degree bank. The 12 cylinder engine givers 4,500 horsepower. The C40-8s feature a 4,000-horsepower (at 1,050 rpm), 16-cylinder 7FDL prime mover, with a 12.7:1 compression ratio and turbocharger. The engine idles at one of three speeds (340, 440, or 580 rpm), depending on temperature. The units are over 70 feet long, 15 feet, 4.5 inches high and a few inches over 10 feet wide. They weigh 395,000 pounds and hold 5,000 gallons of fuel, 385 gallons of cooling water, 410 gallons of lube oil and a total of 44 cubic feet of sand. The C40-8s use the 752AG traction motors and generate 108,600 pounds of maximum continuous tractive effort at 11 mph. The 83:20 gear ratio gives a top speed of 70 mph. The high-capacity, extended-range dynamic brakes can supply 79,000 pounds of retarding force down to six miles per hour.

The GEVO prime mover meets EPS Tier-2 emissions. To ease maintenance, the intake and exhaust manifolds are located between the cylinder banks. GE's partner on the development, doing design, analysis, and validation, was FEV, a German company with a presence in the United States. One innovative addition was the ability of the engine to measure its the amount of dissolved gases in the lubricating oil.

The various units of GEVO, the consolidated control architecture, communicate with ARCNet. These units include the DC traction controller, the radiator fan controller, the battery charge controller, the aux. Alternator controller, the traction alternator controller, the engine control unit, and the traction blower controller. The system incorporates three 10” LCD smart display screens for the operator.

HDL Series

The GE 7HDL-16 is used only in the AC6000CW locomotive. It is rated at 6,250 horsepower, with 15.7 liter cylinders, and twin turbochargers .It was developed at the peak of the GE versus EMD horsepower race. In partnership with Deutz-MWM of of Germany, they achieved 6,250. First production was in 1995. Shipments began in 1996. There were teething problems, that pushed back full production until 1988.

CSX has re-powered many of its units from the 7HDL to GEVO-16 prime movers.

Meanwhile, in 2001 in Australia, eight AC6000's teamed up to set a world record for both the heaviest and longest train. This was 98, 159 tons, and 862 cars, hauled 171 miles.

Powerhaul

The P161 is a 16-cylinder diesel, based on the Jenbacher design. It is a 4-stroke engine, with the Miller Cycle. This design provides more fuel economy at 3,700 horsepower output. It is also designed to be low emissions. Exhaust gas re-circulation will be used in a subsequent model to meet stringent EU emissions standards.

Ge also manufactures a series of natural gas engines, currently, only for stationery use.

NRE Prime movers

NRE uses the Genset concept for prime movers, in which several smaller diesels and generators are used in place of one large one. This has some advantages to reliability and emissions. It also allows the same engine, what whatever number are required, across the power range. They typically use Cummings or Cat diesels.

This 4-axle switchers have three Cummings QSK19C prime movers, developing 700 H.P., and each having its own generator or alternator. This is all computer controlled, reducing emissions, and enhancing efficiency. The correct number of diesels can be operating or shut down as the load requires. The computer can select the engines on a rotating basis, providing load-leveling.

CSXT Painting and Lettering Schemes

The rather boring first CSX paint scheme was gray. Luckily, only 11 units were painted in this scheme, and units acquired from predecessor roads retained their unique, yet faded paint. In 1987, a new paint scheme was used, retaining the grey car body, but with a blue underframe, and on top of the long hod, and the top of the cab. The gray still blended in with the fog. It was referred to as the "stealth" paint scheme.

A yellow-nose paint scheme was formulated to enhance visibility. The yellow nose treatment was added to predecessor paint schemes in lieu of a complete repainting. The *pumpkin* orange paint scheme was used for easy identification of Maintenance of Way units. The next paint scheme, YN2, sometimes referred to as *Bright Future.* Introduced in 1990, it combines a blue and gray body with a yellow nose.

YN1 is no longer used. The current schemes are YN2, YN3 (almost ½ of the fleet). And YN3B. If you want to see good pictures of these, the Internet is awash of good roster pictures.

In 2002, CSXT No. 8503, an EMD SD50 was painted in the new yellow and blue YN3 scheme. More than 1,000 CSX locomotives have since been painted in the YN3 scheme.

The most recent CSX paint scheme is known as YN3b, which updates YN3 with the most recent CSX logo. The first unit to wear this scheme was ES44AH 950. Many units were repainted at the Huntington Locomotive Shops.

In the mid-1990s, CSXT began placing a lightning bolt decal below the road number on locomotives with AC traction. This practice continues with the new GE ES44AH and ET44AH locomotives.

Because painting is an expensive proposition, it is not done until needed. More restrictive rules on solvent usage, venting of fumes and non-contamination of ground water has made large scale paint shops expensive to operate. They must implement filtered venting and solvent recovery. Usually, heated areas are used to expedite paint drying. Because of the expense and loss of revenue hours while the units are in the paint shop, some CSXT power retains its original predecessor paint. All ex-Conrail units in active service have been repainted.

A new state-of-the-art paint shop was constructed by CSXT at Huntington in 1998. It is the largest such facility on the CSXT.

More than 1,000 CSX Units have been painted in the YN3 scheme. There's a variation on that, called YN3b. This incorporates the latest corporate logo. A few CSX locomotives have predecessor logos, so CSX can maintain legal control over the logo use. Intellectual property conveyed with the big iron.

AC units have a lightning bolt below the road number.

The Bright Future paint scheme is accompanied by the Lubalin Bold font for the CSXT lettering.

Heritage Locomotives

CSX has included the names of predecessor lines on some of their locomotives. Not all the predecessor lines are as yet represented. All are painted in the YN3b scheme. The ones in place as of this writing are shown below.

256	CW44AC	YN3b - Seaboard Coast Line
323	CW44AC	YN3b - Louisville & Nashville
366	CW44AC	YN3b - Chessie System

616	CW46AC	YN3b - Seaboard Airline R.R.
3010	ES44AH	YN3b - Gainesville Midland
4384	SD40-3s	YN3b - Clinchfield
5327	ES40DC	YN3b - Western Maryland
5461	ES40DC	YN3b - Seaboard System
7332	CW40-8	YN3b - SBD System (Retired 2017)
7376	CW40-8	YN3b - C&O (Retired 2017)
7670	CW40-8	YN3b - Monon
7889	CW40-8	YN3b - Atlantic Coast Line

CW44AH unit number 5107 is Lettered “William Thomas Rice Special” to honor his contributions to CSX. Rice started out as a track inspector for the Pennsy, He served later as President of the RF&P. Later as President of the ACL. He worked with legendary Hays Watkins on the creation of CSX.

Spirit Locomotives

Number	Type	Lettering
CSXT-1	CW44AC	Spirit of West Virginia
CSXT-12	CW44AC	Spirit of Louisville
CSXT-295	CW44AC	Spirit of Clinchfield
CSXT-356	CW44AC	Spirit of Brunswick
CSXT-391	CW44AC	Spirit of Dante
CSXT-454	CW44AC	Spirit of Magnolia
CSXT-500	CW44AC	Spirit of Grafton
CSXT-601	CW60AC	Spirit of Waycross
CSXT-602	CW60AC	Spirit of Maryland
CSXT-700	SD70AC	Spirit of Cumberland *
CSXT-2702	GP38-2	Spirit of Atlanta ***
CSXT-3440	ET44AC	Spirit of Ravenna
CSXT-4589	SD70AC	Spirit of Nashville**
CSXT-4590	SD80AC	Spirit of Benning
CSXT-4685	SD70M	Spirit of Mulberry
CSXT-4688	SD70M	Spirit of Tampa

CSXT-4699	SD70M	Spirit of Miami
CSXT-5500	ES44DC	Spirit of Cincinnati
CSXT-5555	B30-7	Spirit of Cartersville

* renumbered 4500 after being wrecked and repaired. “The” was dropped.
** once 2702, this unit was renumbered after repainting in YN3.
*** “Franklin M. Garrett” (Family Line) was added after a repainting,

In addition, some units include a logo of a predecessor road, as a tribute. These include:

Seaboard Coast line, Unit 256.
Louisville & Nashville, Unit 323.
Gainesville Midland, Unit 3010
Georgia Railroad, Unit 3415.
Western Maryland, Unit 5327.
Seaboard System, Unit 5461.
Chessie System, Unit 7765.
Clinchfield, Unit 4384 (no longer wears the logo)
and, in honor:
First Responders, Unit 3099.

CSXT older units, no longer on the roster

In May 1983, almost 200 first-generation diesel locomotive units, most in predecessor road paint, were waiting at Cumberland, Maryland, for disposition by CSXT. Included were many units in predecessor road paint. Not wishing to create a rail photographer's dream location, CSXT bracketed the units with coal hoppers. Most extant pictures of the units are from overhead. A few survived in museums, but most went as trade-ins, or as scrap.

In October 1985, there were 268 older units in storage in Cumberland. In March 1987, sixty-one locomotives went dead-in-train, pulled by three motive power units, from Cumberland to Midwest Steel in Youngstown, Ohio. The vintage diesel consist was more than ½ mile long. In April 1987, 60 more locomotives went on their last journey over the rails.

Is is a continuous process, as older locomotives are sold or traded in on new units. The Roster changes daily. Just in November of 2018, 37 units left CSXT service. These ranged from SW1500's , MP- and GP-15's, GP-38's and -40's, SD40-2's, and more single types. By November of 2018, three SW1500's, 1104, 1109, and 1111 went to LTEX.

Some went to Larry's Truck and Electric, a repair facility and scrapper in Ohio. Sometimes, an older locomotive is valuable as an organ donor, or parts no longer manufactured. Sometimes a unit has been driven into the ground, and is only worth its scrap value.

Other destinations include Progress Rail in Alabama, a division of Caterpillar, and Locomotive Specialist in Waycross, GA. Some vintage units go to tourist railroads, for their restoration.

Miscellaneous First-Generation EMD switchers

Among the various first generation EMD switchers that CSXT inherited in 1986 were models SW-7, SW-9, SW-900M and TR-3. Most of these survived only a short time. Most of the units discussed here have been scrapped, with a few going to museums.

SW7 9676, ex-C&O 5224, was an example of this class of first-generation switcher, dating from 1949-1951. They weighed 246,000 pounds and used the 1,200-horsepower, 12-cylinder, type 567A prime mover. They pulled 46,000 pounds at 8.3 mph and did not have dynamic brakes. They were built early in 1950 and had a 600 gallon fuel tank, indicative of their yard use. Early units such as 5224 were not equipped for MU. Unit 5224 did, however, last until 1988.

SW9 models 9637-9639 (old 5081, 5083 and 5256), 9646, 9647 and 9664 (old 5092, 5093 and 5263) weighed 247,000 pounds. They had the 1,200-horsepower, 12-cylinder, type 567B prime mover. They were built in the period 1951-1953 and used by the B&O and C&O. They developed 46,000 pounds of tractive effort, at 8.3 mph. There were not equipped for MU. The units came from the factory without side railings, but these were generally added later. Unit 9646 went to the B&O Museum at Mt. Clare.

Only two TR-3 units were ever built, these for the C&O in October 1949. TR stood for Transfer. These were C&O 6500and 6501 (A, B and C). These units became CSXT 9556 and 9557. These were triple units, drawbar-connected cow & dual calf. They used the 1,000-horsepower, 12-cylinder, type 567A prime mover in each unit. The total unit weight was 251,200 pounds and they were rated for 33,300 pounds of tractive effort at 7.5 mph. For low speed switching service, this 12-axle lash-up did good work Their original service was at the Russel Kentucky yards.

The SW900M model used the 900-horsepower, eight-cylinder, type 567C prime mover. A total of 260 units were built in the period 1954-1965 for U.S. roads. The ‘M’ model indicated a rebuild of old EMD SW or SC switchers, traded-in. These circa 1936-1939 models had their original 201-A prime movers removed, but the original generator was reused. CSXT numbered these models 9400-9428. They weighed 230,000 pounds and used the 62:15 gearing. They developed 35,000 pounds of tractive force, at 7.5 mph. The fuel tank held 600 gallons of diesel. The last unit in CSXT service was number 9408, in mid-1990. Ex-B&O unit 633, retired from service at the Koppers Tie Treatment plant at Green Spring West Virginia in August 1991, was donated to the B&O Museum in Baltimore.

NW2

The EMD NW2 model was introduced in 1939. Production was suspended by order of the War Production Board, but resumed after WW-II and continued until 1949. These units were the first to include all-EMD electrical components. A total of 257 units were built. They used the 1,000-horsepower 567 V12 prime mover. At one time, CSXT rostered 16 of these units, with numbers 9527-9529, 9535-9538, 9576, 9578, 9587, 9589, 9540, 9541, 9562, 9569 and 9599. The unit weight was 246,000-248,000 pounds. They used a 62:15 gear ratio. Being a switcher, the units did not have dynamic brakes. They managed a tractive effort of 30,800-31,900 pounds at a minimum continuous speed of 8.6-9.8 mph. They had a standard E-type coupler and non-alignment draft gear. They were used by the B&O, C&O and SBD. They had a 600-gallon fuel tank.

CSXT maintained two of these pre-WW-II units: ex-B&O 5065 became 9565 and ex-C&O 9565 (C&O 5075) became 9575. Ex-B&O NW2 9565 was in a special green and white safety paint at the Cumberland Locomotive Shops, renumbered to its original road number in April 1985. It was retired in August 1981 and sold.

GP7

A total of 2,729 original roadswitchers - the GP7 units were built by EMD from October 1949 to the end of 1953. The ‘GP’ stood for General Purpose. They were designed by a GM team headed by Dick Dilworth, and featured the 1,500-horsepower, type 567B prime mover and a 36-inch dynamic brake fan. The prime mover drove a D12 generator rated at 2,200 amps, that fed four D27 traction motors each rated at 825 amps. The GP7s were delivered with a high short hood which most roads considered the front of the unit. Many units subsequently had their short hoods lowered for better visibility. Dynamic brakes were an option on these units. If the customer mainly intended the GP7s for yard use, they usually did not specify this extra-cost item. Units intended mainly for road use got dynamic brakes. The CSXT units did not have dynamics.

These units weighed 243,000-258,000 pounds and achieved a 40,000 pound continuous tractive effort at 11.0 mph. Unit numbers were assigned in the range 2300-2380, later changed to the range 0951-0974. They were equipped with MU 27 pin connectors.

GP7s were operated by predecessor roads WM, C&O, B&O, SBD and L&N. Chessie had 159 of these on its roster in 1982. Only four remained in 1987. Fuel capacity varied from 800-1,700 gallons, depending on the tanks specified by the ordering road. Sand capacity was 18 cubic feet. Twenty-five GP7 units came from the B&O, the 5600 series of road numbers. They carried CSXT numbers in the range 0700-0724. These weighed in at 241,000 pounds, with 1,700 gallon fuel tanks and a 62:15 gear ratio.

A series of GP7s and GP9s came to CSXT from predecessor roads. Because CSXT planned to delete these first-generation units from the roster as soon as possible, they were not repainted or renumbered. A single unit remained on the roster from 1990-1992. CSXT 883, ex-L&N 2368, the last GP7 on the CSXT roster, went to the Millville Quarry in Bladensburg, Maryland, toward the end of 1992. Some GP7s went to EMD as trade-ins on SD50 models for the C&O. Two B&O units became yard slugs: units 1038 and 1039. CSXT unit 0571, from B&O 6571, was downrated to 1,500-horsepower, having a transplant of components from a B&O F7A unit. It was classified a GP9m and was retired by August 1986. Unit 0494 worked at the Huntington Training Center from 1984-1986 as a maintenance training unit and was then sold for scrap.\

GP9

The Chessie System had 496 of the GP9 model in 1982. By 1987, CSXT rostered only six of these units, and they were all gone by 1993. Some went to EMD as trade-ins and some were wrecked. They can also be found on the Maryland Midland, South Branch Valley Railroad and other short lines. The GP9 model featured a 48-inch dynamic brake fan, compared to the GP7's 36-inch fan. The GP9 had the 1,750-horsepower 567C prime mover. It drove a D12B generator, which fed power to the D37 traction motors. A 62:15 final drive gear ratio was used. There were a total of 4,092 GP9 units built by EMD from 1954 through 1959. Predecessor roads using them include C&O, WM, B&O and SBD. The GP9 had a 1,600 gallon fuel tank, carried 18 cubic feet of sand and were equipped with the MU-27 wiring.

The WM units were equipped with dynamic brakes, an option on this model. As with the GP7s, most roads got the high short hood and later lowered it in their shops for better visibility. Former C&O units going to the WM and then to CSXT include:

WM/C&O	CSXT
5933	271
5940	275
5951	282
5952	286
5956	287
5993	315

WM-25 became Chessie-6400 and then CSXT-400 and was subsequently retired. Unit 2389 weighed in at 251,000 pounds and achieved 44,900 pounds of tractive force at a minimum continuous speed of 12 mph. The unit did not have dynamic brakes. Units 209-677 (previous numbers 5905-6677) weighed 256,000 pounds and managed 44,800 pounds of tractive effort. They had standard dynamic brakes.

Unit 5940 was donated by CSXT to the City of Cumberland, Maryland, in 1989. It was a high nose GP-9 unit, ex-C&O and came to town painted in the Chessie scheme. It was repainted yellow and spent time in Ridgeley, West Virginia, just across the Potomac River at the yards of the fledgling Western Maryland Scenic Railroad (WMSR). It pulled a train of local rail enthusiasts to Frostburg on that line in 1989. The City of Cumberland diesel was painted black and lettered in near-WM *speedlettering* style with the road number 40, in the WMSR shops. It was a GP9 high-nose unit.

The City received the diesel as a donation, with the understanding that it would be used for display, or on the WMSR and not be sold. But the City put the engine up for sale and the local National Railway Historical Society Chapter tendered a bid. However, the engine was not sold at bid, but was used as a bargaining chip to resolve issues with the WMSR operator. When the Allegany Central moved back to Staunton, Virginia, the engine went with them. As of the end of 1996, the diesel was still working there in lease service.

Unit 0575, ex-B&O 6575, was used as a maintenance training unit at Cumberland, until scrapped in early 1987. Unit 0598, ex-B&O 6598, was damaged by fire and scrapped at Brocks Salvage yard in Cumberland, Maryland. CSXT 0607, ex-B&O 6607, resides at the B&O Museum, Mt. Clare. Unit 0663, ex-B&O 6663, ex-C&O 6114, was involved in an accident caused by a washout of the track at Stecker (MD) in November 1985, during a hurricane. It was scrapped and buried at the wreck site. (see the note on the GP35 number 4357).

GP11 and GP16

Neither the GP11 nor the GP16 is an EMD model number. The six GP11s were rebuilt by Precision National Corporation (PNC) in 1979 for the Clinchfield. The prime mover was 1,600-horsepower. All of these (No. 1700-1705) were retired from CSXT by 1990. The 1700 series of numbers were re-used for GP16s. The weight of a GP11 was 240,000 pounds and they achieved a 44,800 pound tractive effort. The units were not equipped with dynamic brakes.

The GP16s were rebuilt from GP9s and GP7s by SBD at Uceta Shops in Tampa, Florida. In 1993, 160 units were rostered by CSXT. They weighed in between 236,000-250,000 pounds and were rated at 44,800 pounds of pull. None had dynamic brakes. Fuel tank capacity was 1,300 to 1,600 gallons. Gearing was 62:15. All were retired by April 1993. Units 1733, 1734, 1739 and 1815 went to Emmonds Industries, operator of Yorkrail and the Ma and Pa. Unit 1812 was at Midwest Metalics (ex-Pielet Brothers) near Chicago in the Spring 1998.

GP16	
1700-1745	SCL 4600-4645 (CRR 4600-4605)
1746-1800	SCL 4700-4754
1802-1855	SCL 4756-4809
1856-1860	SCL 4975-4979

GP18

EMD built 350 units of this type for U.S. roads from 1959-63. For a prime mover, they used the 1,800-horsepower, V16, 567D1. It drove the D22B generator, which fed current to D47 traction motors, a maximum of 900 amps each. The GP18 model featured two exhaust stacks and dual 48-inch cooling fans. Visually, they resemble GP7s or GP9s. CSXT got these models from predecessor road SCL. They weighed 246,000 pounds and used a 62:15 gear ratio. They had 1,700 gallon fuel tanks. These GP18s did not have dynamic brakes. They achieved a maximum continuous tractive effort of 44,800 pounds at 12 mph. The last unit on the CSXT roster in December 1991 was unit 1066 from SCL, same number, ex-L&N 900. All units have since been removed from the CSXT motive power roster.

GP35

The GP35s were second-generation EMD roadswitchers. EMD built a total of 1,280 units from 1963 through 1966. The prime mover was the 2,500-horsepower 567D3A prime mover, 16-cylinder and turbocharged. The prime mover drove a D32 generator and it motivated the D67 traction motors, rated at a maximum of 1,000 amps each. The units weighed 260,000 pounds loaded and were equipped with type 26L air brakes. They were 56 feet, two inches long. They carried 2,600 gallons of fuel, 40 cubic feet of sand, 243 gallons of lube oil and 240 gallons of cooling water. They had the 62:15 gearing and the standard MU-27 connectors. Quite a few of the GP35s were converted into road slugs by CSXT. No GP35s were rostered by CSXT by December 1996. Predecessor roads using this model include WM, L&N, SBD, B&O, C&O and RF&P.

The low-nose configuration was the standard, but dynamic brakes were an option on this model. CSXT numbers 4300-4340 were ex-SBD/L&N. Units 4341 through 4398 came from the B&O. C&O units had the Leslie S-3L horn. CSX's GP35 units were scrapped, with some becoming GP39 units on Burlington Northern. All surviving units on CSXT were converted to slugs. No units remain in active service. Consider the fate of GP35 unit 4357, ex-B&O 3517. It was the victim of a track wash-out in November 1985 at Strecker, Maryland, due to heavy rains in the tail end of a hurricane. It was headed west with three other units and eighty coal empties. Unit 4357, with GP9 6663 rolled over four hundred feet down an embankment into the Savage River. It was buried in place. Unfortunately, a crew member was killed in the incident.

B&O numbers: 3500-3519, 3541-3558, 3581.
C&O numbers: 3520-3539, 3560-3575, 3582-3584

RF&P	CSXT	status
131	4425	(never renumbered. retired with old number)
133	4426	
134	4427	
136	4428	(never renumbered. retired with old number)
138	4429	retired 8/93

H-15

The eight CSXT H-15 models were constructed from Seaboard SD35s and SDP35s. The turbochargers were removed, derating the engines to 1,500-horsepower. They were used in hump service. There were five in service in July 1990; all are now retired. Engines used in this program include 1001, 1002, 1005, 1006 (SDP35) and 1003, 1004, 1007, 1008 (SD35). The SDP model is the passenger version of the SD45, with the long nose extended to include an onboard steam generator.

They weighed between 340,000-355,000 pounds and achieved a 77,200 pound tractive effort at 9.4 mph. Fuel tank capacity was 3,000 to 3,300 gallons. These units used the 62:15 gearing and were not equipped with dynamic brakes.

SD7

Units 9700-9704 (ex-B&O 1826-1830) weighed 370,000 pounds. They had a 1,500-horsepower prime mover and carried 2,400 gallons of fuel and 50 cubic feet of sand. They pulled 67,000 pounds at six mph. The units did not have dynamic brakes.

B&O 1828 drifted into the turntable pit at Cumberland on July 12, 1985 and was rescued by the *Big Hook*. There was minor damage to the fuel tanks. Unit 9702 was sold to Brock's Salvage Yard in Cumberland. Three units went to the Burlington Northern Railroad and the disposition of one is unknown. They did not survive to 1990.

SD9

SD9s were 1,750-horsepower units that weighed 368,000 pounds. They used the D12C generator and D27 traction motors, rated at 900 amps each. Road numbers were 9706-9715, from B&O units 1831-1840. B&O’s SD9 number 1838, was ballasted to be the heaviest B&O diesel in service before the SD35s arrived. The unit was retired in 1987. The SD9s had a 1,750-horsepower prime mover and standard-range dynamic brakes. They carried 50 cubic feet of sand. Units 1839 and 1840 had 2,400 gallon fuel tanks, in place of the 1,200 gallon tanks on the other units. The SD9s achieved a tractive effort of 67,000 pounds at 7.6 mph. Several of the SD9 units went to Brock's Salvage in Cumberland, while others went to the Burlington Northern Railroad.

SD18

Eighteen of these 1,800-horsepower units, using the 567D prime mover, were built by EMD in 1960-1963 for the C&O. The C&O units were low-nose, built on traded-in ALCO RSD-5 trucks. They were numbered in the 7300 series. They weighed 363,000 pounds and developed 72,000 pounds of tractive effort at seven mph. They carried 2,400 gallons of fuel and 46 cubic feet of sand. Unit 7318 had 129 cubic feet of sand capacity because of the experimental IDAC wheel-slip control system. The units had the 74:18 gearing. The SD18 units had the Leslie S5T horns and standard, tapered control dynamic brakes. The SD18s were to carry CSXT numbers 1070-1088, but were not renumbered. The units were retired in 1987, sold for scrap or to short line carriers. Unit 7305 went to the B&O Museum at Mt. Clare, but was subsequently sold.

U25B

These 2,500-horsepower units from GE introduced the use of the FDL-16 prime mover. The U25B units were built between 1959 and 1966, and came to CSXT from the L&N. None of the C&O's U25B units made it to CSXT service. The CSXT units were numbered 3400-3426, from L&N 1600-1626. All were retired before 1990.

Unit 3416, ex-L&N 1616, was donated to the B&O Museum, Mt. Clare, Baltimore. It was repainted and renumbered back to the L&N scheme and is currently on loan and displayed in Tennessee.

A U25B’s prime mover was started using the main generator as a motor, connected to the battery. No dynamic brakes were ordered on these units. Standard weight was 266,000 pounds. They held 2,600 gallons of fuel, 32 cubic feet of sand, 365 gallons of lube oil and 290 gallons of cooling water. They featured speed-sensitive automatic transition, and managed a maximum continuous tractive effort of 57,200 pounds at 13.7 mph.

U25Bs had both electrical and pneumatic sanding controls. Most importantly, they could also convert the newer electrical control to the older pneumatic control for mixed consists. Later units had electrical sanding control only. Thus, the U25Bs serve as a transition unit for older U-boats in a mixed lash-up of motive power. The U25B models introduced a 16-position throttle. These are interoperable with both EMD and older GE eight notch throttles.

The U25B introduced a new air handling system that separated the engine cooling air from the combustion air. Air intakes were located near the top of the locomotive. As these units were used mostly in switching service by CSXT, they were designated type SU25-B.

U28C

This model was an upgrade of the U25B, rated at 2,800-horsepower and were built from 1965 through 1966. The U28C featured a new truck design, without equalizers and with the springs over the journals. The U28 units were also available in a passenger version. The increased horsepower from the prime mover was a result of design changes made by the engine development laboratory at Erie. The GT-598 dc generator was used, and the traction motors were model E-6. A load-timing (electrical) panel controls fuel flow, to prevent excessive fuel delivery during transition. Oil-bath air cleaners were fitted.

Units 3526-3529 came from L&N numbers 1527-1532 via SBD. They weighed 377,000 pounds and developed 80,000 pounds of pulling power at 10.4 mph. They had extended-range dynamic brakes and used a 74:18 gear ratio. All were gone from the line by 1990.

U30B

The U30B is an upgrade to the U28 series, rated at 3,000-horsepower from the FDL-16 prime mover. A total of 291 of these units were built for the U.S. market from 1966 through 1975. They are externally identical to the U28B models. They carry 3,550 gallons of fuel, 60 cubic feet of sand, 380 gallons of lubricating oil and 300 gallons of engine coolant. Units 8223 and 8224 had 2,900 gallon fuel tanks and 48 cubic feet of sand. The U30B models came to CSXT from predecessor roads SCL, L&N and C&O. Those numbered in the range 5300-5327 were previously SCL 1700-1718 and L&N 2500-2509. C&O units 8200-8234 became 5328-5362. The C&O units had MU and Leslie SL-3L-R horns. They were also equipped with rock pilots front and rear and used AAR trucks. All were gone by 1990.

U30C

The U30C is the six-axle version of the U30B. It had the same gearing and fuel capacity as the U30B. GE built a total of 592 from 1967 through 1976. C&O units 3300-3312 came to CSXT. They featured a main alternator and extended-range dynamic brakes, usable from 23 down to six mph, were available. The unit weight was 390,000 pounds. Standard capacities were 4,000 gallons of fuel, 48 or 60 cubic feet of sand, 380 gallons of lube oil and 385 gallons of cooling water. The C&O units had two different truck types. Units 3309-3312 have the General Steel Casting (GSC) truck.

L&N units 1470-1582 and ACL units 3021-3024 came into the SBD and the CSXT numbering system as 7200-7280. One U36C unit, previous number 7305, had a prime mover downrated to 3,000-horsepower and the unit was reclassified as a U30C, number 7281. This unit has since been retired. All thirteen ex-C&O units have been retired and scrapped.

All U30Cs on the CSXT used the 74:18 gear ratio and had standard type-E couplers. The prime mover was rated at 3,000-horsepower and the unit developed a maximum continuous tractive effort of 90,600 pounds at 9.6 mph. The prime mover was started with the assistance of two starting motors, or with the auxiliary generator.

Most U30C's saw coal service on the Corbin Division. Some of the units were retired in predecessor paint, and some got the blue and gray, or the all-Grey CSXT stealth scheme.

U33B

The U33B was an evolution of the U30 series with a FDL-16 engine rated at 3,300-horsepower. The unit specifications and capacities are the same as the U30. A total of 135 were produced for U.S. roads. CSXT units 5600-5627 came from SCL units

numbered in the range 1720-1747. All are now retired from active service.
These units weighed 264-266,000 pounds and developed a 54,100 pound tractive effort at 12 mph. They had standard-range dynamic brakes and used a 81:22 gear ratio.

U36B

The U36B 4-axle power is essentially identical to the U33 models, but had a FDL-16 prime mover rated at 3,600-horsepower. One hundred and twenty five were built from 1967 through 1970. Units numbered 5700-5805 by SBD and CSXT were previously SCL units numbered 1748-1855. All are now retired.

These units weighed 268,000 pounds and developed 54,100 pounds of tractive force at 12 mph. They used standard-range dynamic brakes and the 81:22 gear ratio. They had a 3,250 gallon fuel tank and gearing could be 81:22, 83:20, or 74:18.

U36C

The three-axle version of the U36 series was built from 1971 through 1975. A total of one hundred and twenty four were produced for U.S. roads. CRR units 3600-3606 became SBD and then CSXT 7300-7306. These were retired before 1990.

These units weighed 394,000 pounds and used the 74:18 gear ratio. They had extended-range dynamic brakes and developed 90,600 pounds of tractive effort at 11.8 mph.

MATE

MATE stands for Motors to Assist Tractive Effort. These units were built by GE in 1971-1972 as slugs for the Seaboard, for use on the 10,000-ton Florida unit phosphate trains. These units had no prime mover and must be associated with a mother unit. They can operate up to 30 mph and serve as fuel tankers for the mother units.

Dynamic brakes were not provided. They were built on a U36B frame and were teamed with U36B mother units. They were numbered 3200-3224 by SBD. They came in two versions. Early units (3200-3209) were single-ended, meaning they were coupled only one way to the mother unit. They weighed 264,000 pounds. Later models were double-ended and 2,000 pounds heavier. They had lights on either end and could operate with either end coupled to the mother unit, or between two U36Bs. Models used the 81:22, 74:18, or 83:20 gear ratio. The early models achieved a tractive effort of 108,200 pounds at 9.7 mph. The later models pulled 162,300 pounds at 13.2 mph. They all had alignment control draft gear and E-couplers. The MATES were renumbered 5200-5224 by CSXT. All were retired by 1999.

E8A

The E8 series are considered by many to be EMD's classic passenger engine. Conrail's units saw service on the Executive trains. The E8s feature dual 12-cylinder 567B prime movers, giving 2,250 horsepower. They have circular portholes in the sides, 1,200 gallon fuel tanks and dual exhaust stacks. They use the Blomberg A-1-A truck, with the center axle unpowered. From 1949 to 1953, there were 459 units produced. Conrail E8A units 4021 and 4022 will become CSXT 9998 and 9999. Unit 4022 is ex-Erie unit 833. Both units are HEP equipped. They were repainted into the blue & yellow CSXT scheme.

C39-8

These 3,900 horsepower 16-cylinder units were first delivered by GE in late 1984. CSXT got 10 of these Dash-8 units, and renumbered them in the 7480 series.

C32-8

Only ten of these units were built by GE, and they all went to Conrail. CSXT got get four of these, renumbered starting with 7476. They have the 3,150 horsepower, 12-cylinder prime mover.

C36-7

These units have the 3,600 horsepower, 16-cylinder prime mover. CSXT got a dozen or so, renumbered starting with 7116.

SW-1001

These switcher units feature a 1,000 horsepower, 8-cylinder prime mover. They are 44 feet, 8 inches long, and have a low profile cab. CSXT got about ten of the Conrail units, renumbered starting with 1120. Seven of these remain on the roster. Some of the Conrail units were ex-Reading.

Out to pasture, or worse.

By the end of the year 2017, CSX stored or retired all of their CW40-8, CW40-9, CW60AC, CW60AH, CW46AH, EMD SD50, SD50-2, SD50-3, SD60M, SD60I, SD70M, SD70AC, and SD70AE (SD70ACe) units. The C40-8, B40-8, and B20-8 units stored in Corbin, Kentucky were sold off. As of September 2018, a few CW40-8s, CW40-9s, SD50s, SD50-2s, SD60Is, SD70Ms and SD70AC's are still in service with many already stored.

Positive Train Control

Positive Train Control is a government mandated system to stop a train automatically before certain classes of accidents can happen. It is to be implemented on all U. S. Rail, and on all U.S. locomotives. It targets excessive speed, train-train collisions, movements through misaligned switches, and unauthorized entry into work zones. It cannot handle road-vehicle to train accidents currently. PTC was enabled by the Rail Safety Improvement Act of 2008. The extended deadline for implementation was December of 2018. It appears that not all of the mandated improvements were implemented by the deadline.

The PTC system will know the trains location very accurately via GPS. The locomotive receives and analyzes data from trackside. The system is designed to alert the engineer about speed limit changes and track conditions. If the engineer does not respond in the correct time frame, the system has the authority to apply the brakes, and come to a complete stop. The PTC unit contains an update-able database of track profiles.

The systems relies on new radio technology aboard the locomotive, and many trackside installations. This will eventually be a nationwide system, with interoperability. Various implementations of PTC exist. One is the ITCS, which Amtrak uses, except on the NorthEast Corridor, where ACSES is used. CSX favors ACSES.

Afterword

At any given time, hundreds of CSXT trains are delivery raw materials and finished products to keep the wheels of industry rolling. They are easy to spot in their lively paint jobs – I saw a unit at the Glacier National Park Station this year. They interchange with other railroads across North America. Moving that much material across those distances can only be done by rail. Even when you are asleep, the parades of “stuff” continue to roll.

Glossary of Terms

As with most specialty industries, railroading has its own unique jargon. Here are some of the modern terms.

AAR - Association of American Railroads, an industry trade group representing primarily the major freight railroads of North America (Canada, Mexico and the United States)

Ace - A nickname for EMD's SD70ACe locomotive.

ACSES - Advanced Civil Speed Enforcement System, a positive train control cab signaling system developed by Alstom.

Advanced Train Control System (ATCS) - A system of railroad equipment designed to ensure safety by monitoring locomotive and train locations, providing analysis and reporting, and automating track warrants and similar orders.

AEI - Automatic equipment identification - An automatic tracking system using RFID technology.

ALCOhaulic- A nickname for the DH643 diesel-hydraulic locomotive built by American Locomotive Company(ALCO).

Alligator - ALCO RSD-15 locomotive, so named for its long, low nose.

ARCnet – communications protocol for a local area network.

AREMA – American Railway Engineering and Maintenance-of-way Association.

ASIN – Amazon Standard Inventory Number.

ASME – American Society of Mechanical Engineers.

A-unit - A diesel locomotive equipped with a driving cab and a control system for other locomotives in a multiple unit connection ; lead unit in a consist of several locomotives controlled from a single unit.

A&WP – Atlanta & West Point Railroad, Georgia, went to Seaboard, and CSX.

B-Boat – a GE B23-7, B30-7, or B36-7 locomotive.

BLET – Brotherhood of Locomotive Engineers and Trainmen.

B-unit - A cabless booster locomotive, controlled from a cab-equipped A unit; sometimes equipped with limited controls for hostling.

Baby Boat - A GE U18B locomotive.

B-B – locomotive has 2 identical trucks, each with 2 axles.

BDC – bottom dead center.

Beans or Going to Beans - Taking a break from work to eat.

Big Blue - A nickname for Conrail due to the medium blue livery that their locomotives were painted.

Big hole - When a train suffers a loss of all brake air and stops or when the air brakes on the train are placed in emergency. It refers to the air ports in the automatic brake valve, the emergency portion being the biggest port or hole. (e.g. over the radio: "We just big holed.")

Big hook – A railroad crane.

Big Mac - A nickname given to EMD's SD70MAC, SD80MAC, and SD90MAC locomotive models.

B&O – Baltimore & Ohio Railroad.

Bolster - A transverse floating beam member of truck suspension system supporting the weight of vehicle body.

Booster – cabless B unit or slug. Although a Slug and a B unit differ in terms of an engine, both serve the purpose of adding more tractive effort.

Brakeman - A train crew member who performs railcar and track management—often a single job description along with switchman. A brakeman manually activated brakes on railroad cars before the advent of air brakes.

Bright Future - CSX tricolor paint scheme, also known as Yellow Nose 2 or YN2.

Bull - A railroad police officer.

Butthead - GM Electro-Motive Division model MP or SW end cab switching locomotives.

Cadillac - A nickname for EMD SD9 locomotives, in reference to their smooth ride quality reminiscent of a Cadillac.

Calf – A cabless switcher, like the=EMD TR1, meant to be paired with a “cow” unit.

CAN – controller area network.

CBTM – (CSX) Communications-Based Train Management.

C-C – locomotive has 2 identical trucks, each with 3 axles.

CCA – GE's Common Control Architecture.

Consist – sequence of railroad cars in the train.

COTS – commercial off-the-shelf.

Cow – switcher engine that could control a second, cabless engine.

CRR – Clinchfield Railroad.

CTC - Centralized traffic control(CTC) A system in which signals and switches for a given area of track are controlled from a centralized location; in CSX's case, Jacksonville, FL.

Cherry - Red colored signal aspects (lights) when mixed with other colors of a signal aspect (e.g. "Two cherries and a lemon" would denote a Red over Red over Yellow aspect colors)

Circus loading- Loading trailers on flatcars sequentially from the end; the standard method of loading in early piggyback service.

Coal drag - A unit train loaded with coal.

C&O – Chesapeake & Ohio Railroad.

CPL - Color position light, A type of signal used most prominently by the Baltimore & Ohio and the Norfolk & Western railroads.

Conductor - The person in charge of a train and its crew.

Consist - The group of rail vehicles making up a train, or more commonly a group of locomotives connected together for multiple-unit (MU) operation.

Control point (CP) - An interlocking, or the location of a track signal or other marker with which dispatchers can specify when controlling trains.

Cornfield meet - head-on collision between two trains.

Coupler – An AAR Type "E" railroad car coupler; The mechanical connector at either end of a railroad car allowing it to couple together with other cars to form a train.

Critter - A small industrial locomotive.

Cut - A set of cars coupled together.

Dark Future - The current CSX paint scheme, also known as Yellow Nose 3 (YN3) or Gold Nose 1 (GN1).

Dark Territory- Rail lines without wayside (train control) signals.

DEMU – diesel electric multiple unit.

Diamond - Level crossing of two railroad tracks, at any angle from 15° to 90°.

Distributed power - Locomotives at the end or in the middle of a train. Can either be manned or automatically controlled. Manned units may be be called "helpers."

Dynamic braking - A method of braking in which the motors on the locomotive wheels generate electric power from the momentum of the moving train, and this power is dissipated through resistor grids as heat.

Dynamite the train - Causing an emergency brake application, intentional or not.

EAB – Electronic Air Brake.

ECU - engine control unit.

EFI – electronic fuel injection.

EGR – exhaust gas recirculation.

EIC – employee in charge.

Eight and sand - Term used to wish train crews well wishes and quick uneventful journey. Comes from notch 8 (the highest power setting of modern locomotive throttles) and to apply sand to prevent wheel slipping.

Elephant style - A consist of multiple locomotives with all units facing forward; resembling the nose-to-tail train of elephants in a circus parade.

Emeralds - Clear aspects (green colored signal lights) indicating maximum allowable speed for that section of track or route. Emeralds are the opposite of "Rubies", red lights

Emerald Express – A CSX unit train from a transfer facility at Annapolis Junction, MD, hauling trash. Called this because of the colors of the cars. It goes through Washington, D.C. to Sealston, Virginia.

Emergency - When a train has made a full brake application due to adverse event, or has lost its train air due to a defective valve (a "kicker"), or a broken air line or train separation. The train crew will normally declare that they are "in emergency" over the train radio, thus warning other trains and the dispatcher that there is a problem.

Engineer - The operator of a locomotive.

EOT - End of train device; A form of electronic caboose with a flashing red light mounted on the end of a train. Also monitors various train functions such as brake-pipe pressure, motion, and GPS location. See also, FRED.

EPA – (U.S.) Environmental Protection Agency.

ERA – European union Agency for Railways.

ERTMS – European Rail Traffic Management System – standards for management and interoperation of rail in Europe.

Ethernet – networking protocol, operates at 10, 100, or 1,000 kilobits per second. Wired or wireless.

ETMS – (CSX) Electronic Train Management System, implementation of PTMS.

EU – European Union

EUI – EMD, electronic unit injectors.

Ex-Con - A former Conrail locomotive, or former Conrail employee.

Fallen flag - A defunct railroad, having either merged or discontinued operations.

FDL – series of GE prime movers. Also, 7-FDL.

FELA - Federal Employers Liability Act; A U.S. federal law that protects and compensates railroaders injured on the job.

FEV- Forschungsgesellschaft für Energietechnik und Verbrennungsmotoren – partner with GE.

FIRE – (EMD) Functionally integrated railroad electronics.

FLY – failure (per) locomotive year.

FRA - Federal Railroad Administration, The agency which oversees rail operation regulations and safety requirements for U.S. freight, passenger and commuter rail operations.

Filet - Converting a double-stack container train to single stack by removing the top layer of containers, allowing the rest of the train to proceed along track that lacks double stack clearance. The removed containers can be trucked to local destinations. The opposite process is toupee.

Flares – The EMD SD45, with its dynamic brake blisters and radiators that distinctively flare from the top of the unit.

Foreign power - Motive power from one railroad that runs on another railroad's right-of-way.

FRED - Flashing rear-end device. A form of electronic caboose with a flashing red light mounted on the end of a train. Also monitors various train functions such as brake-pipe pressure, motion, and GPS location..

Frog - A casting with "X" shaped grooves used in switches and crossovers.

Gandy – A 5-foot lining bar, used to leverage tracks into position.

Gandy dancer - A track maintenance worker.

GARR – reporting mark for Georgia Railroad and Banking Company.

GATX – rail car leasing company, also owns American Steamship Company, on the Great Lakes.

GECX – GE Capital Leasing.

Geep - A nickname for EMD's GP series of locomotives.

Genset - generator set, a locomotive that uses multiple high-speed diesel engines and generators, rather than a single medium-speed diesel engine and a single generator. Designed to reduce air pollution and fuel consumption.

GEVO - A nickname for GE Evolution Series locomotives, in reference to the GEVO-12 engine used in those units

Ghost - An unpainted (but usually numbered) locomotive that has not yet been painted with company's livery.

Giga - 10^9

Goat - A locomotive used in yard switching service.

Gold Nose 1 (GN1) or YN3 The current CSX paint scheme.

GPS – global positioning system, U. S. Satellited navigation system.

Green Goat - A type of "hybrid" switching locomotive utilizing a small diesel engine and a large bank of rechargeable batteries.

GSM-R – Global System for Mobile Communications – Railway.

HALT - highly accelerated life testing

Hammerhead - A GE locomotive with "winged" radiators, when running long hood forward. A nickname given to certain early ALCO roadswitchers with a high nose, as well as the GE BQ23-7.

HATX – Reporting mark of Helm leasing corporation.

Helper - A locomotive temporarily coupled to heavy-tonnage trains to assist them over steep grades.

HEP – head end power – electrical power for trailing passenger cars.

High ball - A term for a clear signal, derived from the days of steam where a station operator would hoist a large wooden ball up a standard, signaling that the engineer was authorized to proceed. A slang term used among railroad employees to convey to the crew of a train that they were clear to proceed.

High cube - A boxcar whose vertical clearance is excessive.

HLCX – Helm Financial Corporation's reporting mark; lease agency.

HMU – human machine interface.

Hog law - The federal hours-of-service law that forbids certain classes of railroad employees, including those operating trains, from working longer than a certain time after reporting for duty. Currently 12 hours.

Horse Power – a measure of work performed, invented by James Watt, to allow comparison of a steam engine with a team of horses.

Hostler- originally, one who took care of horses; extended to mean some one who takes care of iron horses, in moving them in and out of service faculties.

Hogger – locomotive engineer.

Honorary steam engine - Common term for Alco diesel locomotives, due to their tendency to blow clouds of black smoke when throttling up, due to turbo lag.

Horsepower hour – rated horsepower times hours active – a measure of usage for billing purposes.

Hospital train - A train composed of defective "bad order" equipment or locomotives that are en route to a repair shop.

Hotshot - A fast, long-distance train given priority on the track over other trains.

HPPI – Heavy Haul Power International, a freight operator.

HEUI – hydraulically activated electronic unit ejector .

Hump yard – a classification yard, with a small hill and multiple destination tracks. Nowadays, a lot of trains are Unit, so classification in the yard is not required.

ICE - Integrated cab electronics.

IDAC - Instantaneous Detection And Correction.

I-ETMS - A Wabtec implementation of PTS.

IFC – GE locomotive control system.

IGBT – insulated gate bipolar transistor high voltage, high current switch.

Interlocking - A location that includes a switch or crossing of two tracks, derived from the early practice of installation of a system of mechanical equipment called an interlocking plant to prevent collisions. Interlocking is also the term for the actual mechanical or electrical apparatus that prevents switch/points and signals from being operated in ways that would allow for conflicting train movements.

ITCS – Incremental Train Control System, implementation of PTC.

Juice Train - A unit train of Tropicana cars.

Kilo – 10^3

LAN - local area network.

LCD – liquid crystal display

Level junction- A junction in which all track crossings take place at grade and routings must therefore be controlled by signals and interlocking.

Light engine - A locomotive unit traveling to a destination without a train attached. Can be a power pool transfer (relocation of a surplus of locomotives from one location to another), or can be a helper locomotive/locomotives being sent or returning from helping a heavy tonnage train over a grade.

Lightning Slinger – A telegraph operator.

Lineup or lined up - To have switches aligned correctly before a move.

LMSX - Locomotive Management Services.

L&N – Louisville and Nashville Railroad.

LOD – locomotive operating display;

LTEX – recording mark for Larry's Truck and Electric, Ohio. Locomotive Sales, repairs, and rebuilders.

LTU – Load Test Unit - use the dynamic braking units as a simulated load for testing purposes.

Maintenance of way (MOW) - The maintenance of a railroad's rights of way, including track.

Manifest - A freight train with a mixture of car types and cargoes. Also known as a Mixed Freight Train.

MARC – Maryland Area Rail Commuter.

Mega - 10^6

M&K, I – Morrison-Knudsen, Boise, Idaho.

M&K, P - Morrison-Knudsen, Pennsylvania

Mother - A locomotive that is paired with a slug.

MoW – maintenance of way.

MPI – Motive Power Industries, locomotive manufacturer, merged with Westinghouse Air Brake to form Wabtec.

MU - Multiple-unit train control - The ability of diesel and electric locomotives or multiple units to be joined together and controlled from one driving station. Such a set of joined locomotives is called a consist or (colloquially) "lash-up" and is said to be "MUed together".

NRE – National Railway Equipment.

Notch 8 – the highest throttle setting on a modern locomotive.

NYC – New York Central. Went to Conrail.

Outlawed - Train crew members who have reached their daily 12-hour maximum of hours worked and must cease working due to regulations.

Overhaul - A train of exclusively locomotives, usually retired, that exceeds the ordinary maximum number of locomotives in one train.

Patch - A locomotive or car wearing a new reporting mark or number on a "patch" over existing paint, usually of the former owner's.

PC-104 – small form factor standard for embedded systems boards.

Pig train - A train devoted exclusively to intermodal traffic, generally trailers on flatcars (TOFC) or containers on flatcars (COFC).

Plate - The measurement of a freight car's vertical clearance. Plate F and above is considered excess height, and such cars must avoid low-clearance routes .See also:Loading gauge.

PMSM – permanent magnet synchronous motor.

PN - Precision National, Illinois.

Power assembly – EMD, a cylinder head, cylinder liner, piston, piston carrier, and piston rod.

PPA – PTC preventable accidents.

Progress Rail (Services) – a subsidiary of Caterpillar, in Alabama.

PTC – positive train control.

Pumpkin - CSX's s maintenance-of-way bright orange paint scheme.

Quarterly inspection - In the United States, a federally-mandated safety inspection performed on a locomotive every 92 operating days.

Railpower – R. J. Corman locomotive builders.

Rainbow consist - a group of locomotives of different colors or liveries leading a single train.

Rent-a-wreck - A (usually old) locomotive owned by a leasing company

Reporting mark - A code assigned by the Association of American Railroads to identify the owners of rolling stock in North America.

RFID – Radio Frequency Identification.

RF&P - Richmond, Fredericksburg, and Potomac Railroad.

Right way - A "high nose" locomotive running with the long hood facing forward.

Road engine- The locomotive closest to the train during a double-heading operation.

Road slug – a slug unit intended for road use, as opposed to yard use.
ROC – rate of change.

Roll-by - Visual inspection of railroad equipment while it is in motion.

Rolling Bomb - A unit tank train usually carrying flammable liquids.

RS-232 – heritage serial communications protocol, point-to-point.

RSIA – Rail System Improvement Act.

Rule G - The universal rule prohibiting the use of drugs and alcohol.

SCL – Seaboard Coast Line.

Slack action - Looseness in a train caused by mating clearances in couplers.

Slug- A locomotive, with or without an operator's cab, which lacks a diesel engine, and draws power for its traction motors from a normal locomotive, known as a "mate" or "mother."

STB – Surface Transportation Board.

T4C – added to a GE indication to signify Tier 4 (emissions) Credit Unit.

TDC – Top Dead Center.

Terminal station - A station sited where a railway line or service ends or terminates.

TES – (NRE) Truck Engine Switcher.

Torco – wholly owned subsidiary of CSX for the Toledo Ore Docks.

Toupee - When a single stack train coming from reduced clearance territory has additional containers placed on top for the rest of its trip; the opposite of filet.

Train order - A system for authorizing main track occupancy using telephone, telegraph, and wayside stations to pass authority to train crews.

Trops – Tropicana reefer boxcar. Shortened from Tropicana, referring to the orange or white refrigerated boxcars used to haul frozen concentrated orange juice to packaging facilities north of Florida. Term is specifically used by CSX crews in Cincinnati Terminal where a large such packaging facility is located.

TSM - fuel measurement system using radar technology, from TankScan.

Truck - The undercarriage assembly of rolling stock incorporating the train wheels, suspension, brakes and, in powered units, the traction motors

U-Boat - GE Universal Series locomotive.

UI – unit injector.

UK – United Kingdom (England)

Unit train – consist of identical car types.

Unix – Open Source operating system, originally from Bell labs.

Unit train – all of the consist is going to the same destination.

VFD – variable frequency drive.

VMV Enterprises – locomotive rebuilder and manufacturer in Kentucky.

Wabco – Westinghouse Air Brake Company.

Wabtec – Westinghouse Air Brake Technologies Corporation.

WM – Western Maryland Railroad.

WRA – Western Railroad of Alabama.

Wye - Three railroad tracks in a triangular form with switches at all three corners—can be used to turn a train around.

X-ing - crossing.

YN1 - CSX's first yellow-nose paint scheme; gray overall with dark blue on the top half of the cab and yellow on the front of the nose; blue "CSX" lettering.

YN2 - CSX's second yellow-nose paint scheme; more yellow on the nose; the whole cab is dark blue, along with a stripe on the side; blue or yellow "CSX" lettering.

YN3 - CSX's third yellow-nose paint scheme; dark blue overall with a yellow nose; yellow "CSX" lettering.

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P. O. Box 325
Valrico, FL 33594-0325

Affiliation for Baltimore & Ohio System Historical Research
Dwight Jones
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Columbus, OH 43228

Baltimore & Ohio Railroad Historical Society
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P.O. Box 79
Clifton Forge, VA 24422.
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Louisville, KY 40217
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